SCIENCE STORIES

BOOK THREE

CURRICULUM

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CURRICULUM FOUNDATION SERIES

SCIENCE STORIES

BOOK THREE

by

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Part 1 WHERE DO LIVING THINGS LIVE?

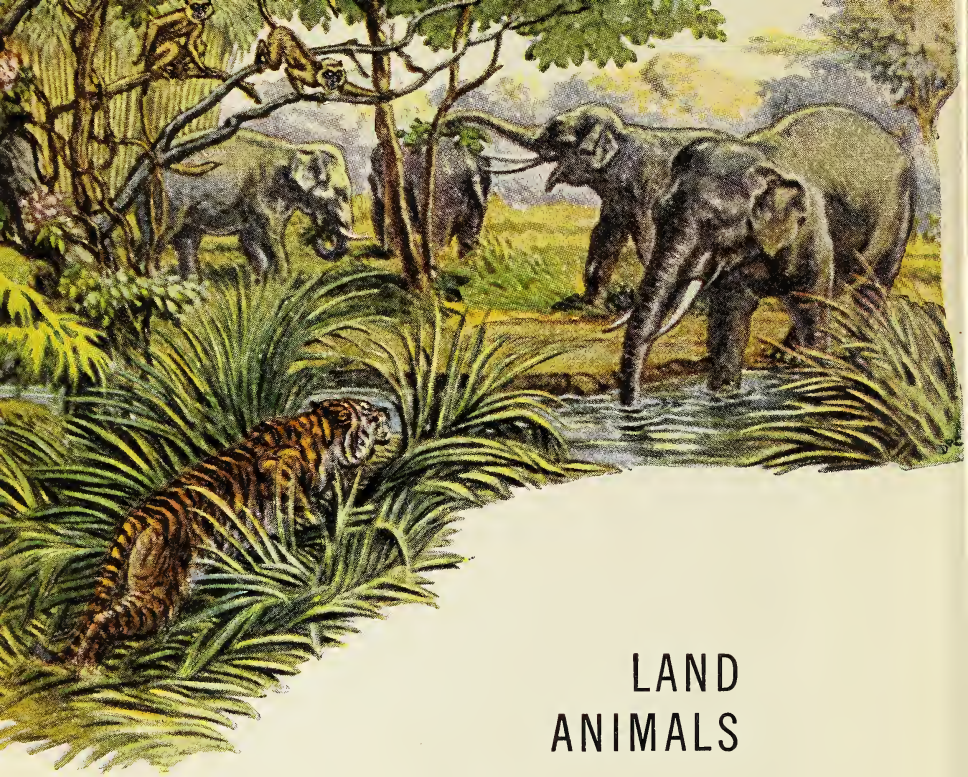
The beautiful bird in the picture is a swan. Her home is a big lake where she can swim.

We do not often see a swan, but we see many other living things around us all the time.

We see rabbits and chipmunks on the ground and butterflies moving from flower to flower. We see squirrels and birds in the trees. The trees and flowers and the grass under our feet are living things, too.

Living things are everywhere around us. They are on the ground and in the ground. They are in the air. They are in the water.

In Part One you will find out how some living things can live on land and how some can live in water. And you will learn about others that can live both on land and in water.



LAND ANIMALS

Here are some animals that live on land. They live in a great woods called a jungle. They are looking for food.

To get food they must move about. It is often hard to move about in jungles. Big trees and thick bushes grow so near together that it is hard to push through them.

Read the next story to find out how these animals can live in the jungle.

Old Tusk and the Tiger

Through the jungle tramped Old Tusk and his herd of elephants. They were looking for a new feeding ground.

Their feeding grounds were large open places in the jungle, where there were few trees and bushes.

In these places the elephants found enough thick grass and small plants to feed them for many days.

When the elephants had eaten all the plants in one feeding ground, they had to tramp through the thick jungle to find a new feeding ground.

Their tough, heavy feet tramped over sticks and stones, and their big bodies pushed through the thick bushes. They even pushed down trees with their heads to make their way through the jungle.

As the elephants tramped along, Old Tusk and some other big elephants came first. Then came the mothers and the young elephant calves. After them came some more big elephants.

In this way there were always big elephants near the elephant calves to take care of them. If any jungle animal tried to catch a calf, he always found some of the big elephants in his way.

Tramp, tramp, tramp went the elephants. Jungle mice and other small animals hurried out of their way. A monkey went through the trees near them, looking for fruit to eat.

There was no tramping along between the trees for Monk. He stayed up in the tree-tops and used his long arms and his hands to move from branch to branch.

At last the elephant herd came to a river. On the other side was a good feeding ground.

The elephants could cross the river easily, for they were good swimmers.

Some of them stopped to drink. They sucked the water up into their long trunks. Then they pulled up the ends of their trunks and squirted the water into their mouths.

As the elephants crossed the river and began to eat, another animal saw them.

He was a hungry tiger, and a baby elephant was just what he wanted to eat.

One young calf had moved a little way from the herd. He was pulling up green plants with his trunk and lifting them into his mouth as fast as he could.

The tiger moved softly through the high grass. The calf did not see him, for the light and dark colors on the tiger's coat were like shadows and sunshine in the grass.

Nearer and nearer came the tiger. He was getting ready to spring at the calf.

But Old Tusk saw him and came running through the grass.

With his trunk held high and his white, pointed tusks shining in the sunlight, he charged straight at the tiger. The tiger sprang out of his way.

Old Tusk charged again. But again the tiger sprang quickly out of the way of the elephant's sharp tusks and heavy feet.

Then the tiger sprang at the elephant. But Old Tusk was not hurt by the tiger's long claws, for his skin was thick and tough.

He turned quickly, this way and that, and the tiger fell to the ground.

The tiger was ready to spring again. But he saw the elephant's pointed tusks and his lifted foot that could easily kill a tiger.

He turned and ran as fast as he could go between the trees. Old Tusk could not run fast enough to catch him.

So the tiger had no elephant calf to eat. And after that the little calf stayed very, very near his mother.

How Do Animals Live on the Ground?

Moving About to Get Food

Old Tusk, Monk, and the tiger all went through the jungle to get food.

Old Tusk tramped along on the ground, looking for plants to eat.

Monk moved through the tree-tops, looking for fruit to eat.

The tiger moved softly through the grass, looking for animals to eat.

Parts of their bodies made them able to move through the jungle easily. So we say that these parts "fitted" them for living in the jungle.

Old Tusk was able to move through the jungle because his feet were big and tough and his legs were strong. These parts of his body fitted him for tramping from place to place to get his food.

Most land animals are fitted to move about on the ground and look for their food.

A rabbit hops easily about, looking for plants to eat.

His back legs are very strong. They help him jump a long way each time he hops.

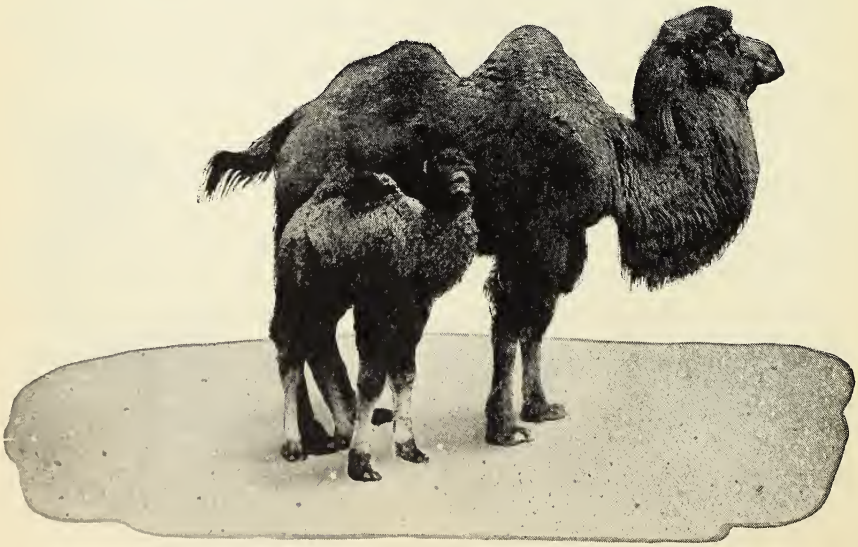
This squirrel makes his home in a tree. His food is mostly nuts, which he gets in the trees and on the ground.

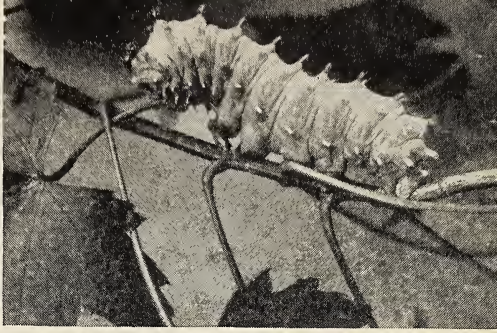
How easily he runs up a tree trunk and jumps from branch to branch! He often climbs far out on small branches to get his food.

Look at the long, sharp claws in the picture of a squirrel's foot and tell how they help him move along a branch.

A camel's feet help him move about in the sandy desert. His feet are wide and flat and do not go down into the sand.

So a camel can walk on soft sand for hours at a time.





Some animals do not walk or hop or run. They crawl on the ground or on trees, bushes, and other plants.

How well this caterpillar's feet are holding on as he crawls along! He is crawling on a twig to eat the leaves that are growing there.

Name five other land animals and tell how each one moves about.

Getting Water

Living things must have water. While animals move about to get food, they get water, too.

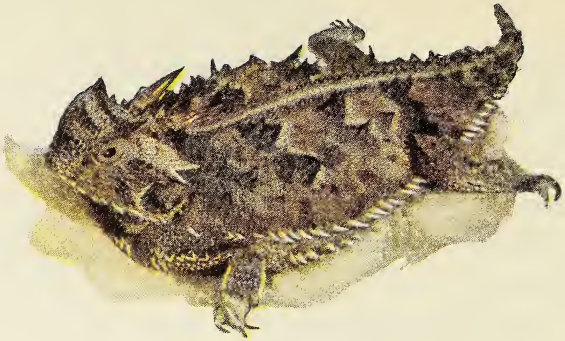
An elephant sucks it up into his trunk and squirts it into his mouth. A hen takes water into her bill, then lifts her head and lets the water run down her throat.

How does your kitten get water into its body? How do you get water?

Keeping Water

Your body has a tight covering that goes over every part of it. This covering is your skin.

Inside your skin your body is moist. You drink water to keep it moist.



Your skin helps keep your body moist. It keeps it from drying out in the air and sun. In the same way the skins of dogs, cats, horses, and other land animals keep their bodies from drying out.

The skins of many land animals have tiny openings that let out a little water at a time. Your skin gets moist on a hot day because water comes through these tiny openings.

Some animals have skins that do not let water out at all. We say their skins are "waterproof."

The animal in the picture has a waterproof skin. He is called a horned toad. His skin keeps his body from drying out, even in the hot, dry desert where he lives.

Getting Air

Did you ever try to hold your breath? How did you feel? You cannot hold your breath very long, for you must have air to live.

Air is all about you. You take it into your body through your nose or mouth. It goes down into two lungs in your chest.

Can you feel your chest move up and down as you breathe? As your chest goes up, air goes in. As your chest goes down, air goes out.

All day long, and even at night when you are asleep, you breathe air in and out of your lungs.

All animals with hair or fur breathe with lungs.

Caterpillars and all other insects have openings in their sides through which they breathe. These openings are called spiracles.

Most land animals have either lungs or spiracles for breathing the air about them.

Pages 9 to 17 have told you three ways in which animals are fitted to live on land.

They can move about on land.

They have skins that keep them from drying out.

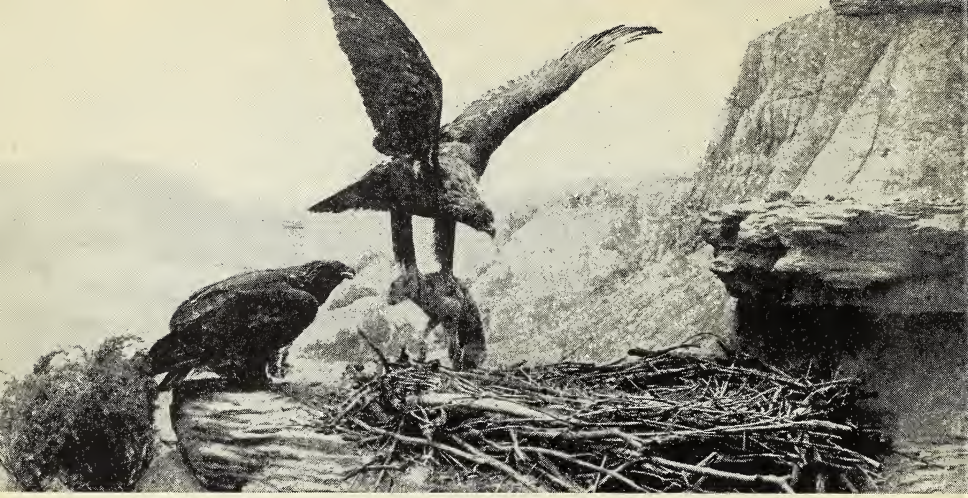
They can breathe the air about them.

How is an elephant fitted for moving on land?

An elephant has lungs. How do lungs fit him for living on land?

How is a squirrel fitted for living in the trees?

Name three other land animals and tell how they are fitted for living on the ground.



The Hunter

High at the top of a mountain lives a hunter.

Every few days he goes down to the valley and carries off what he wants to eat.

He catches a squirrel or a rabbit in his claws, and takes it back to his home.

If you tried to carry a rabbit to the hunter's home, you would have a hard climb.

You would have to crawl over great rocks where it would be very easy to fall. Your hands and feet would be cut by rocks and bushes.

You would not be able to climb all the way and would have to give up and go back.

Almost the only way to reach this hunter's home is to fly. And that is just what the hunter does! For he is an eagle.

How Do Animals Fly in the Air?

Many land animals can fly. Animals that can fly have wide wings that spread out flat. Their bodies are not heavy like yours, but small and light.

Their wings can move up and down and lift their bodies high into the air.

In the picture of the eagle you can see how the feathers spread out and make the wings flat and wide. And the wings are much larger than the eagle's body.

What is this bird? He, too, can fly, but he cannot fly very far. His body is large and heavy, and his wings are not large enough to lift him very high or carry him a long way.

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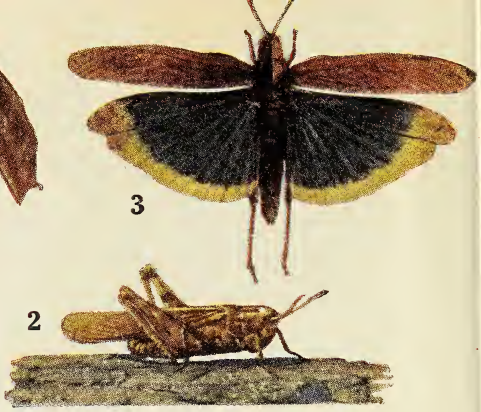

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2

The animal in Picture 1 is a bat. The bat is not a bird, but he looks like one as he flies through the air. His wings are made of skin that spreads from his fingers to his feet! He flies at night and catches flying insects for his food.

Have you heard the story that bats fly into people's hair at night? This might happen, but not if the bat could help it. He is too busy getting his food and much too afraid of people!

Many insects can fly, too.

Picture 2 shows a grasshopper on a twig. In Picture 3 the grasshopper has spread his wings.

Are his wings larger than his body or smaller?

He uses his wings to go from one field to another as he looks for plants to eat.

His legs are so strong that he can jump farther than you can! He jumps from plant to plant, and his feet hold on to a plant while he eats its leaves.

Picture 4 shows how a housefly looks when we see it through a magnifying glass. The magnifying glass makes it look much larger than it really is.

Look at a fly through a magnifying glass and tell how its wings look.

Are they larger or smaller than the fly's body?

If there is no food near the fly, its wings carry it to a place where there is food.

What other parts of a fly's body help it move about while it is getting food?

The butterfly in Picture 6 gets its food from flowers. Its big wings carry it easily from one flower to another. Its feet hold on to the flower while it gets its food.

Picture 5 shows a bird that uses his feet to move about as well as his wings. He is a nuthatch. The nuthatch runs along branches and down tree trunks, looking for insects to eat. He is upside down as often as he is right side up!

You have found out that flying animals are fitted to move in the air as well as on land.

They also take in air, as other land animals do.

Birds breathe with lungs. At the back of a bird's bill are two openings through which air goes into its lungs.

Grasshoppers, flies, and butterflies are insects. They have spiracles through which they breathe.

Flying animals are fitted for keeping water in their bodies, just as other land animals are.

A bird's body is covered with skin and feathers.

Grasshoppers, beetles, and many other insects have coverings that are hard and tough like finger nails. If you touch a grasshopper's body, you will find that its covering feels hard.

This hard covering is waterproof. How does a waterproof covering fit a grasshopper for living in places where it is very hot and dry?

How are flying animals fitted to move about?

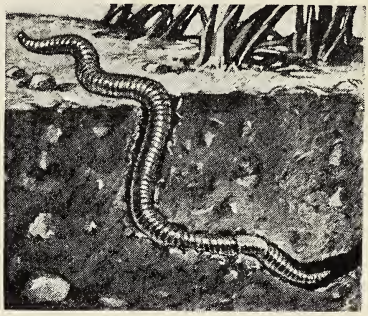
Tell two ways in which flying animals are fitted for breathing.

How are flying animals fitted for keeping water in their bodies?

Name three flying animals and tell how they are fitted to live on land.

How Do Animals Tunnel in the Ground?

An earthworm gets food by moving through the soil, for it eats soil as it goes! It moves through the ground by making tunnels.



It has no legs, but along its body are tiny, stiff hairs. It uses these stiff hairs to move itself along.

Look at an earthworm through a magnifying glass and try to find the hairs on its body.

Watch the earthworm move. How is it shaped? How does its shape change when it moves?

Do you think the earthworm has a good shape for tunneling? Tell why.

Touch the earthworm and see if its skin is dry.

Its skin must always be moist, or its body will dry out. So in the daytime the earthworms stay in the ground, where the soil is moist and cool. They come out at night, when the sun does not dry out their skins.

They take in air through their skins. They can breathe in their tunnels and in the open air above the ground.

This mole is like the earthworm in the way he lives. He is fitted to live in the ground and can tunnel through the earth.

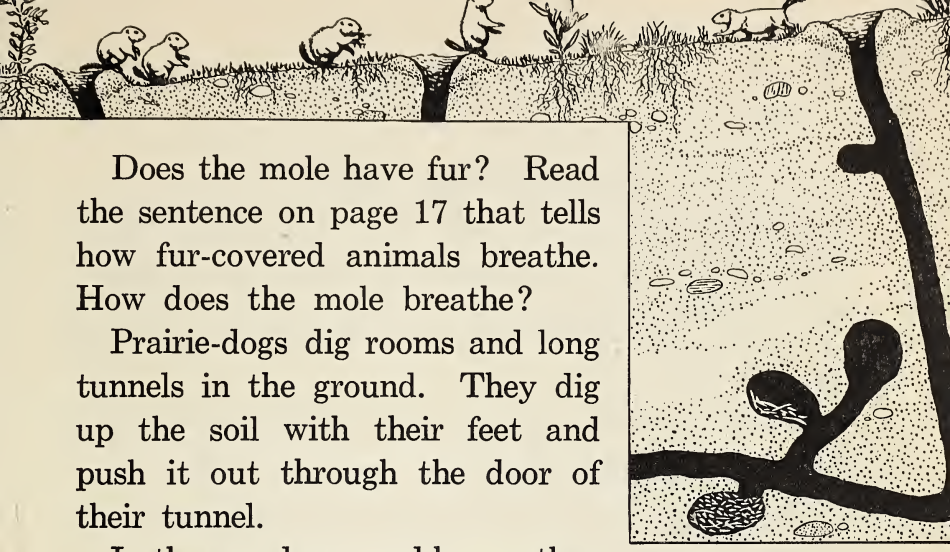
The mole eats worms and insects that live in the ground. He makes his tunnels to find his food.

He tunnels just under the top of the ground and uses his hard, pointed nose and strong front feet to push through the soil.

He pushes his nose into the soil. Then his front feet go in beside his nose and push the soil away.

Again and again his nose and feet push into the soil, and on he goes through the earth!

You can see the top of his tunnel, for he pushes the ground up a little as he moves along. This loosens the soil above him and lets air into the tunnel. So the mole has air to breathe.



Does the mole have fur? Read the sentence on page 17 that tells how fur-covered animals breathe. How does the mole breathe?

Prairie-dogs dig rooms and long tunnels in the ground. They dig up the soil with their feet and push it out through the door of their tunnel.

In these underground homes they store wheat and other food. They sleep in their homes and stay in them in stormy weather.

But they run about on top of the ground to get their food. So prairie-dogs live both under the ground and on top of the ground.

Why do prairie dogs need skins?

Prairie-dogs are covered with fur. Tell how they are fitted for breathing.

Questions to Answer

1. What land animal has such a big body and big feet that he can push his way through a jungle?

2. How does being able to swim help an elephant get its food?

3. What land animal lives in the soil but can move on top of the soil?

4. In what ways are land animals fitted to move?

5. Name two animals that can move on land and in the air and tell how being able to move helps them get their food.

6. In what two ways do land animals take in air? Name an animal that breathes in each of these two ways.

7. Tell three ways in which a rabbit is fitted for living on land.

8. In what ways is an eagle fitted for living on land?

9. How is the mole fitted for tunneling through the soil?

10. How are you fitted for living on land?

Things to Find Out

You may never have seen some of the animals you have just read about. Others you may see often. Watch the land animals around you to find out how they move about to get their food.

1. How does a robin move? How does moving on the ground help him get food?

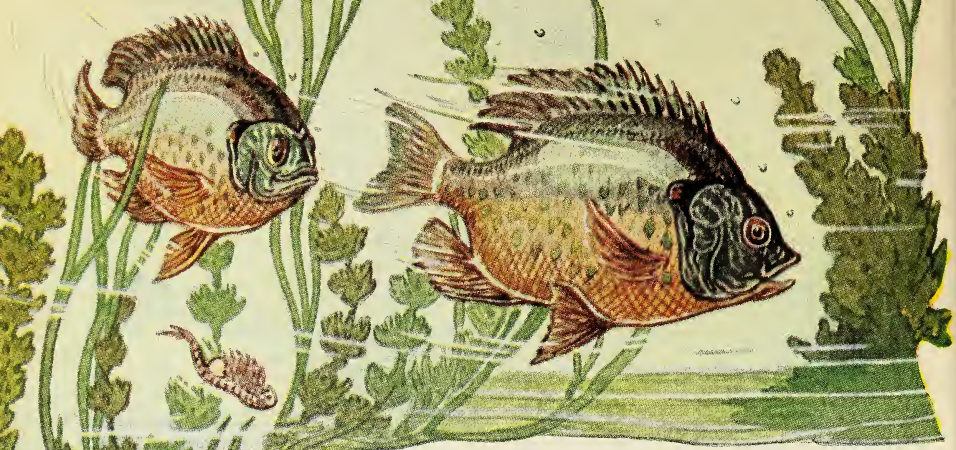
2. When you walk, you must have your feet down and your head up. Find out if a fly or a bee can walk upside down. How does this fit him for living on land?

3. Write the names of all the animals you see in one week. Find out what food each animal eats and how it is fitted to get its food.

4. Put an earthworm on a piece of glass and find out if it can crawl across the glass. Why is it easier for an earthworm to crawl in soil than on the glass?

5. Your book tells you about three kinds of animals that make tunnels. Name them.

If you turn over rocks or old pieces of wood on the ground you will see tiny tunnels going down into the soil. Watch to see what animals make the tunnels. Find out how these animals are fitted for tunneling.



WATER ANIMALS

These animals live in a pond. They are fitted to breathe and move and get their food in water.

Name as many of them as you can.

How does a fish move in water?

We often see some of these animals in a school aquarium. What animals are in your aquarium?

How do the animals in your aquarium move about?

Read pages 29 to 35 to find out how animals are fitted to live in water.

The Trout

This fish lives in a little mountain creek that runs along over rocks and down the mountain-side. He is a trout.

One day the trout was swimming up the creek, looking for something to eat.

As the water hurried down the mountain, it pushed hard against him. But he moved through it easily, turning this way or that to catch a bug or worm.

Soon he came to a place where the water ran slowly. He went to one side of the creek and rested near the edge of the water.

Some butterflies and other insects were flying just above the water where the trout was.

Suddenly he jumped above the water, caught an insect in his mouth, and dropped back into the creek again with a splash!

Soon the trout jumped above the water again and caught a fly. Again and again he jumped to catch an insect.

Then out of the woods came a big black bear. He was hungry, too, and he was on his way to catch a fish!

He stopped at the side of the creek and looked down into the water. He was so still that the trout did not see him.

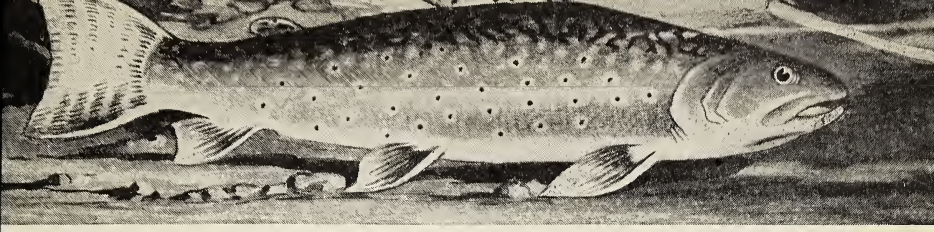
The trout was getting ready to jump again. But as he jumped, there was a great splash, and the bear's front paw went sweeping through the water.

It knocked the trout out of the creek onto the rocks above the bear.

Then the trout could not easily get away from the bear, because he could not move very well on land. He flopped about, this way and that way, trying to get off the rocks and into the water again.

And there was the bear with his great mouth open!

Just as the bear reached for him, the trout gave one last flop and went off the rocks, down into the water again. With a flip of his tail he went swimming off up the creek.



How Do Animals Live in Water?

Moving in Water

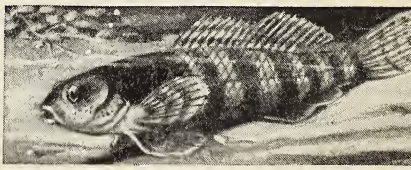
As long as a trout is in water, he can move fast. His strong body has fins and a tail that take him quickly through the water.

Water runs very fast down a mountain-side. It pushes hard against anything in its way. But the shape of the trout helps him swim against the moving water. His long, pointed body moves through the water easily.

The little fish at the bottom of the page can move through the water easily, too. He is called the Johnny darter. How is he fitted for moving?

As he swims along looking for insects and other food, he moves through the water in quick darts.

Very often this fish rests on the bottom of the creek. Then he uses his front fins in a very queer way. He uses them to stand on! Sometimes he even walks along on them.



Another water animal that walks is the crayfish.

Get a crayfish for your aquarium and watch him to find out how he moves.

How many legs does he have?

How does he use his legs?

A crayfish can swim as well as walk. He swims backward!

He has a long, strong tail with little paddles on it that he uses in swimming.

He jerks his tail under him quickly, straightens it out slowly, and jerks it under him again. Each jerk takes him backward through the water.

He looks like a fish as he darts along. And he goes so fast that you have to look quickly, or you do not see him at all.

The crayfish eats small fish and insects that live in the water. He hides under a rock until a fish comes along and then darts quickly after it.

He walks along on the bottom of the pond or creek and digs insects and worms out of the mud.

If he lives in a rocky creek, he climbs over the rocks at the bottom to find his food.

Watch the other water animals in your aquarium to find out how they move.

Breathing in Water

Have you ever watched fish open and shut their mouths? They seem to be eating, even when there is nothing to eat!

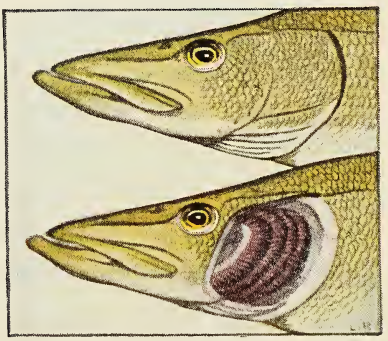
But they are not eating. They are breathing.

There is air in water, and fish can take in air from the water. They breathe with gills instead of with lungs.

A fish's gills are soft and feathery. They are in an opening on each side of his head. Over them is a thin, hard cover that comes open along one edge.

The top picture shows the gill cover, and the bottom one shows how the gills would look if the cover were cut away.

The opening under the cover goes to the inside of the fish's mouth.



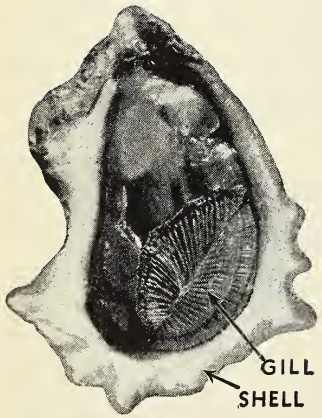
As the fish breathes, he takes water into his mouth. The water goes back through the gills, and the gills take air from it as it runs over them. Then the gill cover opens, and the water runs out.

The fish must have air all the time. So water is always going into his mouth, then through his gills, and out again from under the gill cover.

Watch the fish in your aquarium, and you will see their gill covers open and shut as they breathe.

Many animals that breathe in water have gills.

The gills of the crayfish are on his sides at the places where his legs grow out from his body. They are very hard to see, for they are under the crayfish's shell.



An oyster's gills are easy to find. The curly edges around his body are his gills.

The next time you have oysters to eat, find the gills.

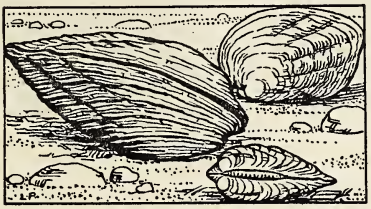
Do Water Animals Have Skins?

Do the animals in your aquarium have skins?

Animals that always live in water do not need skins that keep them from drying out. But they do need skins that protect them from the water.

Water pushes against the animals that live in it. It sometimes knocks them against sharp rocks that are in the water.

If the crayfish is pushed about, his skin helps to keep him from being hurt. His body is very soft, but his skin is hard like a shell.

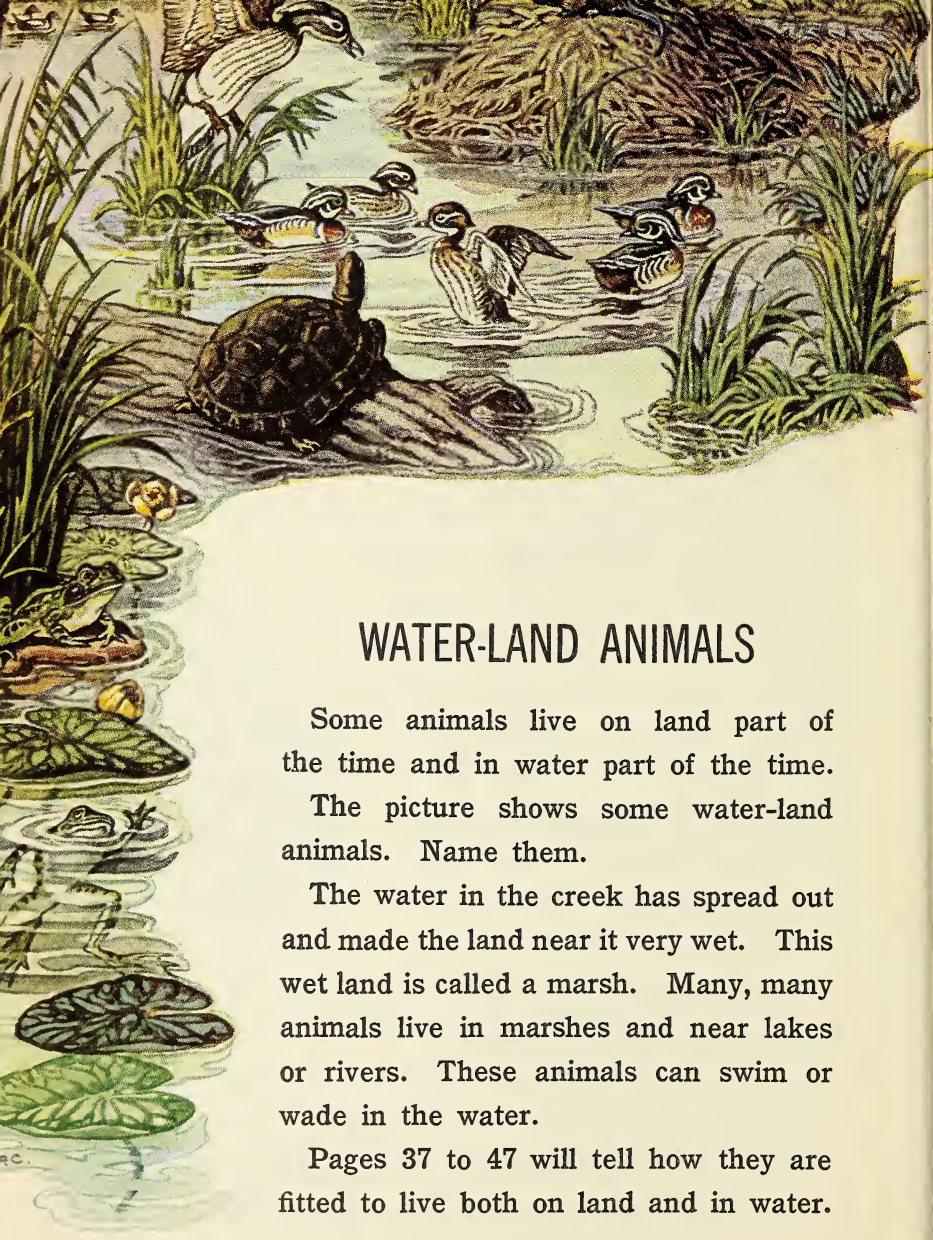


Oysters and clams have very soft bodies, but they live inside of hard shells that they can shut very tightly.

Most fish have scales that cover their bodies. The scales are small and flat and hard, and they fit over each other very tightly, like this.

They make a tight, hard covering that helps the fish's body move through the water easily and protects him if he is pushed about.

What animals in your aquarium have scales? Which ones have shells?



WATER-LAND ANIMALS

Some animals live on land part of the time and in water part of the time. The picture shows some water-land animals. Name them.

The water in the creek has spread out and made the land near it very wet. This wet land is called a marsh. Many, many animals live in marshes and near lakes or rivers. These animals can swim or wade in the water.

Pages 37 to 47 will tell how they are fitted to live both on land and in water.

Waddles, the Duck

When Waddles was still in his egg, he was put under a mother hen. The mother hen was sitting on eggs of her own, keeping them warm until they hatched. So she kept Waddles warm in his egg, too.

One fine morning the eggs began to hatch. What tiny balls of fluff the chicks were!

What a noise they all made! And how excited the mother hen seemed to be when she saw the little duck!

Waddles did not look much like the baby chicks. He had skin between his toes like webs.

His bill was long and wide and rounded on the end, not short and pointed like the chicks' bills. What a time Waddles had, trying to get something to eat with it!

With the strong claws on her toes Mother Hen would dig up worms and seeds for her babies. Then she would call Waddles and the chicks.

They ran to Mother Hen to get the food she had found for them. Waddles could not run as fast as the baby chicks, and so they always got to Mother Hen before he did.

The chicks' sharp little bills quickly picked up the worms or seeds.

But Waddles had a hard time picking up anything from the soft soil with his wide, flat bill. He often got more soil than food.

One day Mother Hen took the baby chicks and Waddles to a field. Through the field ran a creek.

When the little duck saw the creek, he waddled right across the grass and into the water. Waddles could swim!

The baby chicks could not swim. Mother Hen could not swim. They stayed on the land.

Mother Hen called and called to the little duck. But Waddles stayed in the water and went on swimming.

He used his webbed feet like paddles to push himself through the water.

His feathers kept him from getting wet. So he was as warm and dry in water as he was on land.

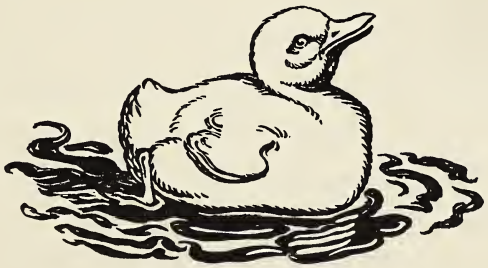
What a fine bill he had for getting food from the water!

He would dive under the water and catch an insect or bite off a plant. When he lifted his head, the water ran out the sides of his bill. But the food stayed right in his mouth.

Mother Hen seemed very much excited because Waddles was swimming in the creek. She stayed on the edge of the creek and made a great noise trying to get him to come out of the water. But Waddles was finding so many good things to eat that he would not leave the water.

From that time on, Waddles lived part of the time on land as land animals do. The rest of the time he lived in the water.

For Waddles was a duck, and he didn't have to live like a chicken!



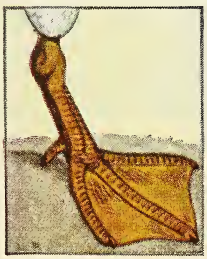
Pelicans

Gulls

Living on Land and in Water

How Water-Land Animals Move

Waddles could move about on land, and he was a fine swimmer. His webbed feet helped him swim.



Pelicans and gulls have webbed feet like Waddles. They swim on the water and dive to catch fish.

They move in the air and on land, too. Their strong wings carry them far across the water to find food.

The pelican often flies high above the water and dives to catch a fish. Splash! he goes into the water and comes up with the fish in his big bill.

Gulls run along at the edge of the water to find clams and other food. They carry clams high over the land and drop them to break their shells, so that they can eat the soft clams inside.

Sandpiper

Beaver

Heron

The heron and the sandpiper live in a marsh or near a lake. The sandpiper runs along on the sand or wades in the water to get worms and insects.

The heron catches fish and frogs. He wades through the water very quietly, or stands and waits for a fish to come near. Suddenly his long neck straightens out. His sharp bill dives into the water and comes up with the fish in it!

How are these two birds fitted for wading?

The beaver in the picture is sitting on top of his house. Beavers make their houses in ponds or marshes, and so these animals are in water much of the time. They have wide, flat tails and webbed feet that help them swim.

They walk about on land to get food, for they eat twigs and bark from trees.

How Water-Land Animals Breathe

Read page 22 again and tell how birds breathe. How do pelicans and gulls breathe?

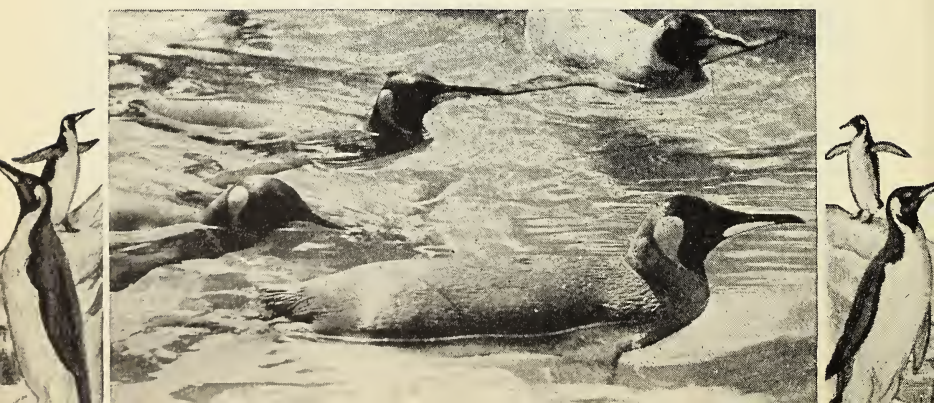
You breathe with lungs. Can you breathe when your head is under water?

When animals with lungs go under the water, they must hold their breath. They must come above the water again to breathe. When pelicans and gulls dive for fish, they hold their breath until they get above the water again.

Beavers make their houses in the water, but the upper part of every house is above the water. So the beavers can breathe when they are inside their houses.

They can hold their breath and swim under water a long way without coming up for air.

These black and white birds are called penguins. They live where the land is almost always covered with ice and snow.

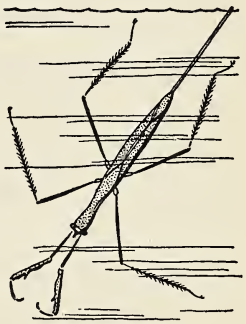


Penguins live on land and on top of the ice. But they go into the water to get their food. They eat fish, which they get by swimming and diving.

Instead of wings, they have flat, wide flippers with which they can swim very fast. They have webbed feet, too.

A penguin has lungs and cannot breathe in the water. However, he can hold his breath for a long time, and so he can swim under water to catch fish.

While he is under water, the penguin lets the air slowly out of his body. Then he must come up to get more air. But he almost always catches his fish before he needs to come up for air.



In this picture is an insect called a water scorpion. It lives in ponds and marshes and eats the many water insects that it finds there. It is under water looking for food most of the time.

It does not have gills and so cannot take air from the water.

But the water scorpion does not hold its breath while it is under water. It has a long, hollow tail. It lifts the end of this long tail above the water and sucks air through it!

A frog has lungs, and so he breathes above water. But when he is a baby, he breathes under water!

A baby frog is called a tadpole.

The pictures show a tadpole growing into a frog.

Picture 1 shows a tiny tadpole. In Picture 2 the tadpole has grown larger. In Picture 3 legs are growing. What has happened in Pictures 4 and 5?

Tadpoles live in water and have gills for breathing. While a tadpole is growing, his gills get smaller and smaller, and lungs begin to grow inside his body. When he has grown into a frog, his gills are gone, and he has lungs for breathing.

Then he lives both on land and in water.

When he goes under water, he holds his breath. After awhile he comes to the top of the water again to get air.

Do Water-Land Animals Have Skins?

Animals that live on the land have skins that keep their bodies from drying out in the air.

Animals that live in water all the time have skins that fit them for living in the water.

Some animals have skins that fit them for both land and water.

Ducks have skins that keep their bodies from drying out when they are on land. Their skins are covered with thick, warm feathers that have oil on them. Water cannot go through the oil. So a duck has a covering that shuts out water and keeps its body warm and dry.

Look at the picture of the beaver on page 41. His body is covered with fur. He has long hair with oil on it, and next to his body he has short hair that is very thick.

He can live in his pond without getting cold and wet, for the oil and the thick fur keep him dry, and keep his body warm.

When he is out of the water, how does his skin protect him?

Look at the pelicans and gulls on page 40 and tell what protects them from the water.

What keeps their bodies from drying out when they are on land?

Questions to Answer

1. Name as many animals as you can that have webbed feet. How do webbed feet help these animals move?

2. Name two animals that get their food in water, and tell if they are water animals or water-land animals. Tell how each one moves.

3. How do animals breathe under water?

4. How do water-land animals breathe when they are in water?

5. What animal builds its home in water but gets its food on land? How does the covering on this animal's body help it live both on land and in the water?

6. Name a water-land animal that can swim and dive in the water, fly in the air, and walk on land. How is it fitted for moving in these three ways? How does moving help it get food?

7. Of what use to an animal are these parts of his body?

lungs	claws	wings
legs	skin	oiled feathers
webbed feet	gills	scales

8. How are you fitted for moving in water?

Things to Find Out

If you look along the edges of a pond or creek, you can see many kinds of animals that live in water. You will see some that live both in water and on land. Watch them and the animals in your aquarium to find out all you can about how they live in water.

1. Find out where a tadpole's gills are.

2. Your aquarium may have several different kinds of snails in it. Watch them to find out which kinds have to come to the top of the water to get air.

3. A turtle is a water-land animal. Find out how he moves in water and on land. Watch him to see if he comes up for air.

4. What does a turtle eat? How does he catch his food?

5. Put an earthworm in a can of soil and let it crawl into the soil. Then pour water into the can until the soil is very, very wet. What happens? Why?

Tell why there are often earthworms on top of the ground after a hard rain.

LAND PLANTS

Plants, like animals, are fitted to live in different places. What land plants do the pictures show?

Plants need food and water just as animals do. They cannot move about to hunt for food. But they have other ways of getting food.

Pages 49 to 67 tell how plants live on land and get the things they need.

Starting Some Experiments

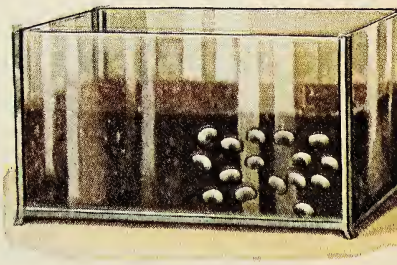
Before you read about land plants, you will need to start some experiments. These experiments will help you find out how land plants get the things they need.

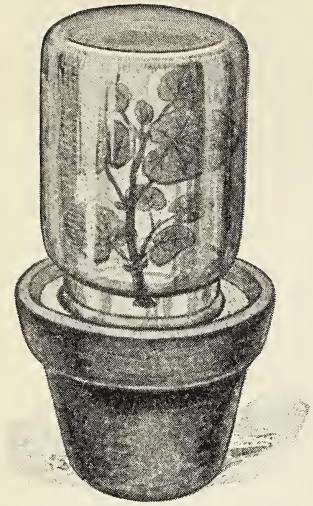
Start the experiments now, and watch to see what happens while you are reading these pages.

Experiment 1. Plant some beans in one end of a glass tank partly filled with earth. Put them against the glass, so that you can see them.

Keep the soil moist until plants begin to grow from the seeds.

Then let the soil around the plants get almost dry, but keep the soil moist in the other end of the tank.





Experiment 2. Cover the soil around the stem of a growing plant with a piece of paper. Be sure that the paper fits tightly around the plant stem.

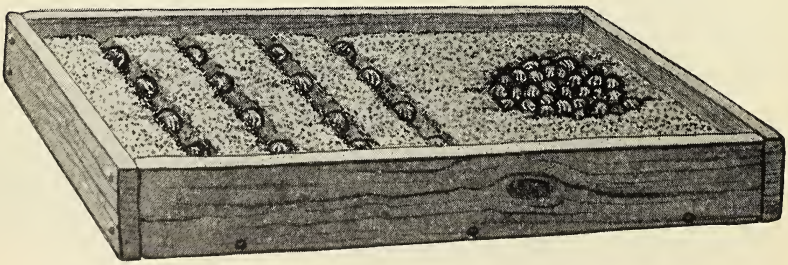
Turn a glass jar over the plant. You may need to put a rock on the jar to hold it down tight.

Keep it in the sunlight for a day.

Experiment 3. Plant some grass seeds in a box of sand in the window. Keep the sand moist.

Experiment 4. Put some nasturtium seeds all together in one end of a box of soil. In the other end put just a few nasturtium seeds, placing them far apart. Cover all the seeds with soil.

Put the box in a window and keep the soil moist.



Sunny Garden

Sunny Garden was back of Sunny House, where Betty lived.

It was Betty's own garden, and she had planted many flowers in it.

There were red poppies in Sunny Garden. There were scarlet runners, sunflowers, nasturtiums, and many other flowers.

Earthworms made their tunnels in the garden.

Grasshoppers hopped and flew about, eating the leaves of plants.

Bees flew from one flower to another to get food. Sometimes rabbits hopped about, looking for leaves and roots to eat.

But Betty's flowers stayed right where Betty had planted them. They did not move from one place to another to find food.

They made food for themselves!

They needed water to make food. Their roots took in the water that the plants needed.

They needed sunlight to make food. Their stems and leaves were in sunlight all day long.

They needed air to make food. There was always air around them.

So the plants in Sunny Garden lived and grew.

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Betty took good care of her garden. She watered the plants when the weather was dry and pulled out weeds. The weeds would have taken water that the flowers needed. They would have shaded the flowers and kept them from getting enough sunshine.

One day Betty and her mother and father went away from Sunny House. They went to another town to live for several months.

Only the sun and the rain and the wind were left to take care of Sunny Garden.

After a while the poppies finished blooming. Then the petals dropped to the ground. On each stem a fat seed pod was growing. Each pod was full of seeds like the seeds Betty had planted.

Soon the pods came open. When the wind blew, the seeds fell out and scattered on the ground.

All the other flowers in the garden were making seeds, too. The wind scattered the seeds on the ground and covered them with leaves and soil.

When autumn came, the plants died. But their seeds stayed in the ground all winter.

In spring the sunshine and rain made the ground warm and moist. So plants grew from the seeds.

One warm day Betty and her mother and father came back to Sunny House.

"I'll have to hurry and get my garden planted," said Betty. "We must have flowers this summer."

She ran out the back door to look at the garden.

How surprised she was! All over the garden little plants were growing. There were scarlet runners, sunflowers, poppies, and many others.

"Mother! Father!" she called. "Come look! Some one else has already planted Sunny Garden!"

Father laughed and said, "It has planted itself, and the rain and sunshine are making it grow. But you must get busy and pull out the weeds, or your garden will soon be all weeds and no flowers!"

How Do Plants Live on Land?

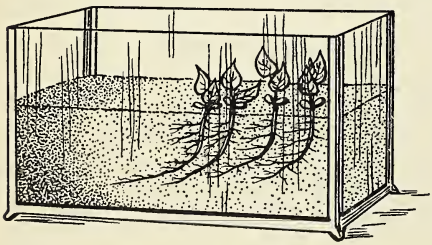
Getting Water

The plants in Betty's garden needed water, light, and air to make food. So do other land plants.

The leaves of a plant make its food. The stem lifts the leaves up where they can get air and sunlight. The roots hold the plant in the soil and take in water that the plant uses to make food.

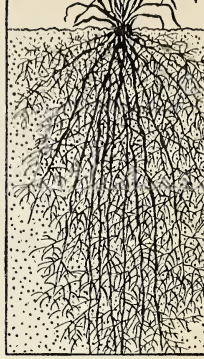
Every day you water the plants in your window. You put water all around them, and it soaks into the soil around the roots. Then the roots soak up the water, and it goes on up into the plant.

But when you water the plants in the tank in Experiment 1, you do not put the water where the plants are growing. You put it in the other end of the tank. So the soil around the plants is almost dry, and the soil in the other end is moist.



Look at the roots of the plants and find out if they are growing toward the moist soil.

The roots reach so far toward the water that they seem to be hunting for it, don't they? The roots of other land plants seem to hunt for water in the same way. They grow toward moist places.



Look at the long roots on this wheat plant. If the soil around it had been kept moist, the roots would have been much shorter.

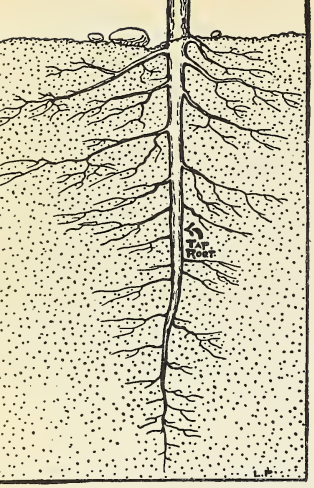
But it did not rain often while the wheat was growing. The soil at the top of the ground got dry. So the roots had to hunt for water.

They grew longer and longer, reaching down into the soil that was still moist.

A big plant like a tree uses a very large amount of water. It must have many, many roots hunting for water.

Here are the roots of a large tree. They look like branches under the ground. The large roots branch into smaller and smaller rootlets.

Through the soil they all go, reaching toward moist places. Some of them grow deep into the ground. Others stay near the top of the ground and spread in all directions. If there is water anywhere in the soil, they find it.



Look at the roots of this tree. The large root that grows straight down is called a tap-root.

The tap-root of a tree grows deep into the ground. It can almost always go deep enough to reach moist soil.

There are many smaller plants that have tap-roots.

The beet and the carrot in the picture below are the tap-roots of the beet and carrot plants.

If a carrot plant or a beet plant is watered every day, the tap-root will not grow very deep. But if the ground is almost dry near the top, the root will grow deeper and deeper as it hunts for wet soil.

In deserts the ground is very dry most of the time. When rain falls, the water soaks quickly into the dry soil. It soaks far, far down, and so there is not much water left near the top.

But cactus plants can grow in the desert. They have long roots that grow down and reach the water that soaks deep into the ground.

Cactus plants also have many roots and rootlets that spread out near the top of the ground. These roots take in water very fast. So when it rains, they get a large amount of water before the ground dries out.

The plant stores this water inside the stem and uses it when the weather is dry.

What part of a plant takes in water?
How do the roots of land plants hunt for water?
How else do roots fit a plant for living on land?

Keeping Water

Water goes from the roots of a plant into the stem and leaves. But the plant cannot keep all the water that it gets. Water goes into the air from the stems and leaves of a plant.

Look at Experiment 2 and tell what is on the inside of the jar. Where did the water on the sides of the jar come from? How do you know?

If plants lose water too fast, they dry out and die. But they are protected from losing water too fast. Each plant has a covering, which we might call its skin. This skin helps to keep water inside the plant.

Trees lose water through their leaves, but they do not lose much water through their trunks and branches.

The trunk, branches, and twigs of a tree are covered with waterproof skin that we call bark. On the trunk of a tree the bark is often very thick, but it is thinner on the branches and twigs.

Even when bark is very thin, it is waterproof.

The stems and leaves of geranium plants are covered with fuzzy hairs. Water cannot go through the fuzz easily. So the fuzz helps to protect the geranium plant from losing water too fast.

Many other plants have fuzz on their stems and leaves. Are any of the plants in your room fitted in this way for keeping water?

Desert plants have tough, waterproof skins. How does a waterproof skin fit cactus plants for living in the desert?

Getting Light

When the plants in Experiment 1 began to grow, the stems did not grow down into the soil.

They grew out of the soil and reached up toward the sunlight.

The stems of the plants in your experiment may be very long and thin. And they may be leaning toward the window. That is because they are hunting for light, just as roots hunt for water.

Most of the light they get is coming through the window. They are growing toward this light, and their stems grow longer as they reach for it.

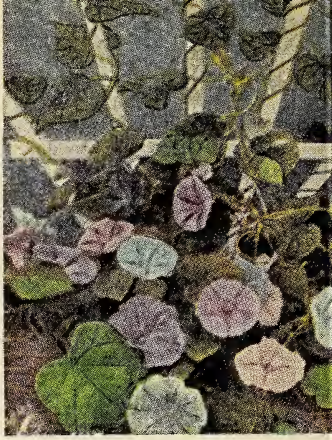
When bean plants grow outdoors, their stems do not have to reach so far to get into the sunlight. So the plants spread out as they grow. Branches grow out from the stem. Leaves grow out from the branches. Soon leaves are spread out in every direction to catch the sunlight.

A tree hunts for light in just the same way. Its trunk grows up, and its branches spread out in all directions. So its leaves can get plenty of air and sunlight.

Look at the grass in Experiment 3. Do you think it is hunting for light? Why?

Ivy Vines

This is how ivy holds on to a wall.



Morning Glories

These plants are vines. They have limber stems and cannot stand up by themselves. Vines get into the light by climbing on walls or on other plants.

An ivy vine has tiny fingers that grow out from the stem and hold on to the wall. So the plant can climb up the wall as it hunts for sunlight.

How do morning-glory vines hunt for light?

Some plants have short stems like this dandelion, and their leaves grow close to the ground. They spread out flat in every direction. So they do not shade each other.

Sometimes high grass shades the plant. Then the leaves do not grow flat on the ground. They reach toward the light like this.

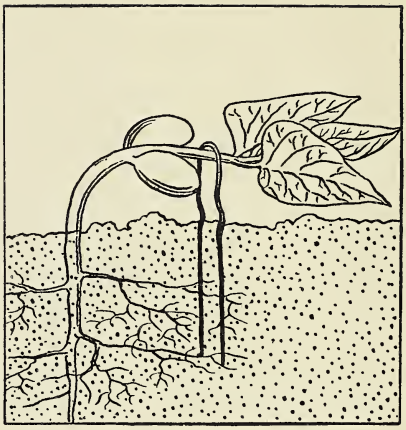
If you have ever walked in the woods, you know that there are many, many plants growing under the trees. They do not get much light, for they are shaded by the trees.

Most of these woods plants grow so that they catch whatever light comes through the trees.

Their leaves spread out like the leaves of the plants in the picture. These leaves do not shade each other. Every leaf is spread to catch as much sunlight as it can.

Many of these plants do not have straight stems. The stems lean away from the shade of the trees and reach toward the sunlight.

You can do another experiment to show that the stems of plants will grow toward the light.



Bend one of your bean plants over and fasten it down to the ground with a hairpin.

Leave it for several days to find out which way the stem will grow.

Then take the hairpin away. Watch the plant for several days and see what happens.

In which direction does the stem grow? Why?

Do all the plants in your window lean in one direction? Why?

Turn them around so that they lean toward the room. Mark the side of the flower box or pot that is toward the room, so that you will be sure no one turns it again.

After several days, tell which way the plants are leaning.

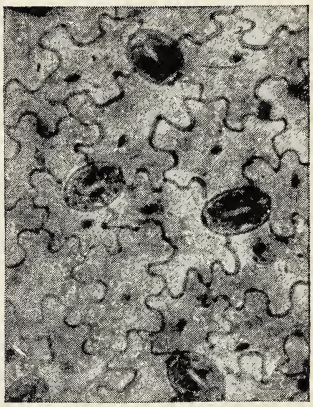
Why do plants need sunlight?

How are plants fitted to get sunlight?

Getting Air

Plants use air in making food. They do not have noses and lungs to take in air, as many animals have. But their leaves have many, many openings through which air goes into the plant. The stems of some plants have these openings, too.

The openings are so very tiny that you cannot see them without using a microscope.



This picture shows how a geranium leaf looks under a microscope. The microscope makes the air openings look two hundred times larger than they really are.

The openings look like little mouths.

Can you see them in the picture?

Look at a geranium plant with a microscope and see if you can find the openings in the leaves.

What does a plant need to make food?
How do plants get water?
How do stems help plants get sunlight?
How do plants take in air?

How Are Seeds Scattered?

Experiment 4 will show you what happens when many plants grow close together.

Some of the plants in the box are close together, and some are far apart. Which ones are larger?

Wet the soil around the plants. Pull up some plants that are close together and some that are far apart. Which ones have more roots?

When seeds dropped from the plants in Sunny Garden, they did not fall close together. They were scattered by the wind all over the garden.

The seeds of many other plants are scattered by the wind. One of these plants is the milkweed.

The big pod in the picture below holds the seeds of a milkweed plant. When the seeds are ready to leave the plant, the pod breaks open.

Fastened to each brown seed is a piece of white fluff. The fluff can float away in the wind and carry the seed with it.

So when the wind blows, away go the seeds.

By the time they fall to the ground, they are scattered far and wide.

These trees have been growing for hundreds of years.

They are redwoods.

The redwoods make seeds that drop to the ground. New trees grow from the seeds.

If all the seeds from a tree fell in one place under the tree, the new plants might not grow well.

They would be shaded by the big trees, and so they might not get enough sunlight.

They would be so close together that their roots could not spread out and get enough water.

But the seeds do not fall in one place. When the wind blows through the redwood trees, it scatters the seeds through the woods.

Redwood Seeds Maple Seeds

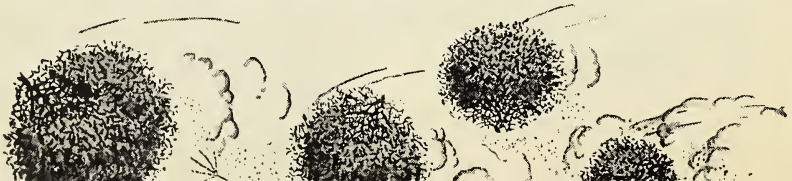
Redwood seeds have small, flat wings that help them ride in the wind.

Maple seeds have wide, flat wings like the wings of an airplane. So they can ride in the wind, too.

Redwood and maple seeds can float on water. Sometimes they fall into a creek or river and float for a long way. If one of the seeds sticks in the soil at the side of the river, a new tree may grow there.

How are dandelion seeds fitted for being scattered by the wind?

Below is a whole plant that moves in the wind and scatters its seeds as it goes. It is the tumbleweed. After the seeds grow, the plant gets dry and hard. It breaks off and rolls in the wind. As it tumbles along, the seeds come loose and fall off.



Some seeds are too heavy to be moved by the wind. They are fitted in other ways for being scattered.

Did you ever pick a burr like this from your clothes and drop it on the ground? You were scattering the seeds of a burdock plant!

The burdock's seeds are inside the burrs. On the outside of each burr are sharp little hooks that help it stick to anything it touches. It sticks to your clothes or to your dog's coat. After awhile it comes off and drops to the ground. So another burdock is planted.

The seeds of cherries and peaches are scattered because they are inside the fruit. When you eat a cherry and drop the seed on the ground, you may be planting a cherry tree.

Tell four ways in which the seeds of land plants are fitted for being scattered.

Why does scattering their seeds make it easier for plants to live?

WATER PLANTS

Animals are not the only living things we find in water. Plants can live in water, too. The picture shows some water plants, and the next pages tell you about them.

Do you think water plants hunt for water, light, and air?

Do you think water plants make seeds? How do you think they scatter their seeds?

Pages 69 to 77 will tell you the answers to these questions.

The Water-Lilies

When Betty's father came home one day, he had some roots with small green stems on them. He did not put them in the ground with the other plants in the garden. He took them to the pool and planted them in the mud at the bottom.

"They are water-lily roots," he told Betty. "Some day they will make pretty white blossoms."

"But how can we see the blossoms?" asked Betty. "Won't they be under the water?"

"No," said Father. "Come with me, and I will show you how they will look."

Father and Betty went to a place where many water-lilies grew in a pool. Wide green leaves and big white flowers almost covered the water.

"Oh!" cried Betty. "The flowers aren't under the water at all. They have long stems that lift them to the top."

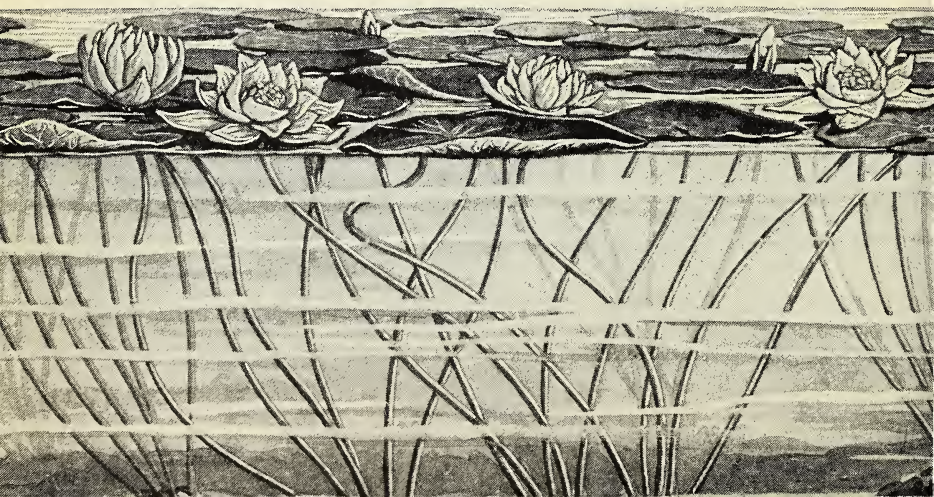
Most of the plants in Betty's garden were land plants. If water had run over the garden, it would have shut off air from their leaves.

But water-lilies are not in danger of being hurt by the water around them. Their long stems lift the leaves to the top of the water. The stems are limber enough to bend as the water moves, and so moving water does not break them.

When the stems bend, the leaves and flowers move on the water. But the roots do not move. They keep the plant from floating away, for they grow into the mud at the bottom of the pond.

It is easy for the roots of the water-lily to get water. They have many little rootlets that take in water easily when they are in mud.

Each long stem that grows up from the roots lifts a leaf or a flower into the light and air.



The leaves are so wide and flat that they float easily. They spread out on top of the water, where they can get sunlight and air to make food.

The leaves take in air through openings, just as land plants do. The openings are on the upper side of the leaves, and so air can go into them as the leaves float on the water.

Water-lilies make their seeds under the water. And their seeds are fitted for being scattered about in the water, so that the new plants do not all grow in one place.

The seeds grow in pods. After the lilies have blossomed, the flower stems curl up and pull the seed-pods into the water.

About two months later the pods open, and out come the seeds.

Each seed is in a little bag that can float. And away it goes across the pond!

At last the little bags fall off. Then the seeds cannot float any longer.

They drop to the bottom of the pond, and so new water-lilies are planted.

Getting Light and Air

Water plants always have plenty of water, for it is all about them. They do not need to hunt for it as land plants do.

But before they can use it to make food, their leaves must get air and light.

Water-lilies start growing deep under the water. But they soon lift their leaves to the top, where they can get air and light.

What part of the water-lily plant fits it for getting its leaves into the air and light?

Duckweed does not need to lift its leaves up through the water, because the whole plant grows at the top of the water.

It gets air and sunlight because it floats!

Duckweed plants are very, very small and light. Their tiny leaves lie flat on the water, like water-lily leaves. They float easily because they are so light.

They have little roots that look like strings as they hang down into the water. The roots do not grow into the mud. They hang loose as the tiny plant floats about.

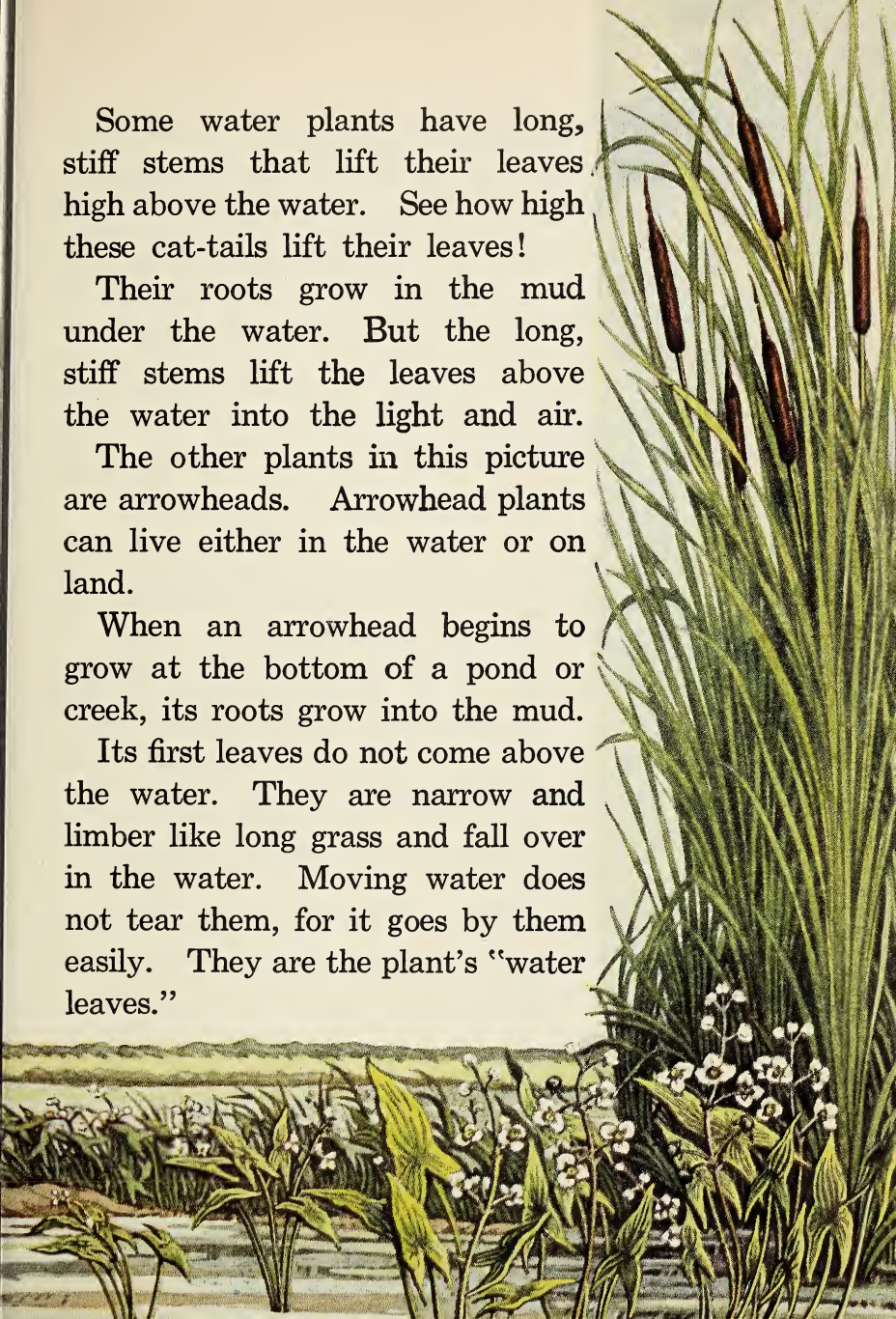
Some water plants have long, stiff stems that lift their leaves high above the water. See how high these cat-tails lift their leaves!

Their roots grow in the mud under the water. But the long, stiff stems lift the leaves above the water into the light and air.

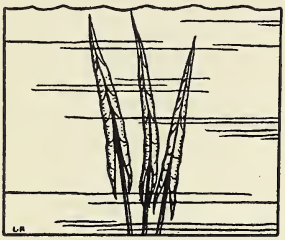
The other plants in this picture are arrowheads. Arrowhead plants can live either in the water or on land.

When an arrowhead begins to grow at the bottom of a pond or creek, its roots grow into the mud.

Its first leaves do not come above the water. They are narrow and limber like long grass and fall over in the water. Moving water does not tear them, for it goes by them easily. They are the plant's "water leaves."



Soon some wide leaves begin to grow. When they start up through the water, they are rolled up in long, tight rolls. So the water does not tear them.



Their stiff stems grow tall and lift them above the water.

Then the leaves spread out in the sunshine and air. They are "air leaves," and they get the air and light that the plant needs to make food.

They are shaped like the heads of arrows and give the plant its name.

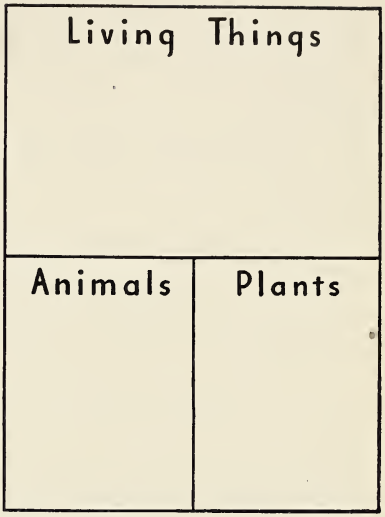
Some of these arrow-shaped leaves are narrow and some are wide. So on the same plant you may find different kinds of leaves. You may find wide air leaves, narrow air leaves, and narrow limber water leaves.

On arrowheads that grow on land, you will find only air leaves. Water leaves do not grow unless the plant is in water.

All water plants that have flowers make seeds. The seeds float away in the water, or they are blown away by the wind. So the new plants that grow from them do not all grow in one place.

Making a Chart

Take a large piece of paper and make a chart like the one shown here.



Read all the sentences below. Under "Living Things" write the ones that tell about *all* living things.

Under "Animals" write the sentences that tell *only* about animals.

Under "Plants" write the ones that tell *only* about plants.

1. They are fitted for moving about.
2. They grow.
3. They have to have food.
4. They use air, water, and light to make food.
5. Their roots take in water.
6. They must find their food.
7. They take in air through their leaves.
8. They have to have air.
9. They have to have water.
10. They grow toward light and water.

Questions to Answer

Your chart will tell you the answers to these questions.

1. Tell four ways in which all living things are alike.
2. In what ways are all animals alike?
3. How are plants alike?
4. How do plants get food?
5. What do plants use to make food?
6. How do animals get food?

You can find the answers to the questions below in the part of your book that you have already read.

7. How are fish fitted to get air? What pages in your book answer this question?
8. Name another water animal and tell how it is fitted to move. How is it fitted to get air?
9. Name a land animal that moves on the ground. How is it fitted for moving on the ground?
10. Name a land animal that is fitted for moving in the air. How is it fitted for flying? Can it move on the ground, too? How?
11. Name a land animal that lives in the ground. Tell how it is fitted for moving through the soil.

12. Page 17 tells you about animals that breathe with lungs. Look at page 42 and tell how these animals get air when they swim under water.

13. Name a water-land animal and tell how it moves on land, and how it moves in water. How does it breathe?

14. How do plants get water? Find the page in your book that answers this question.

15. How do plants get air? What page in your book tells you?

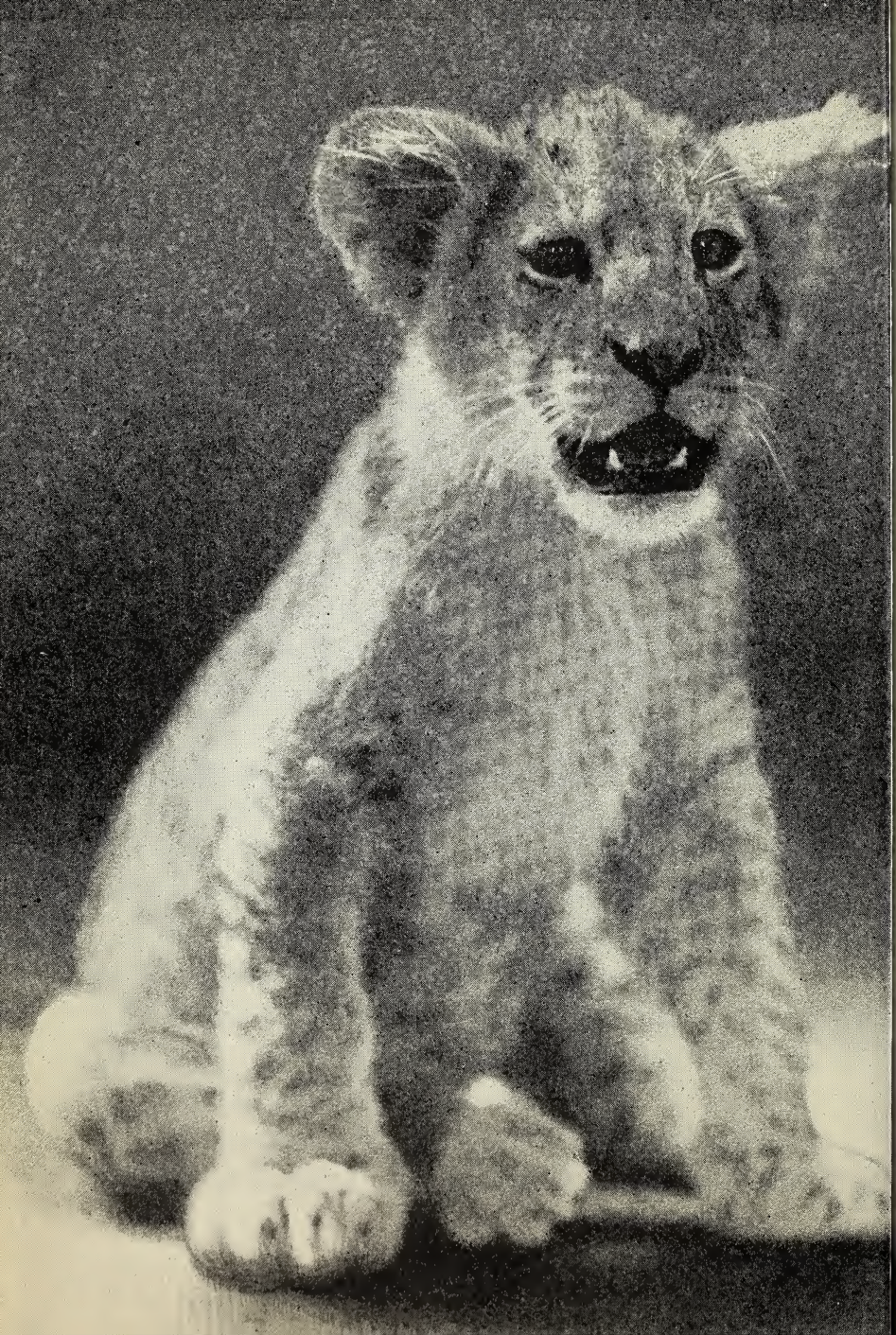
16. How do plants reach the sunlight?

17. How do roots help a plant live on land?

18. How does a plant's skin help it live on land?

19. Name a land plant and tell all the ways in which it is fitted for living on land.

20. Name a water plant and tell how it gets its leaves into the light and air.



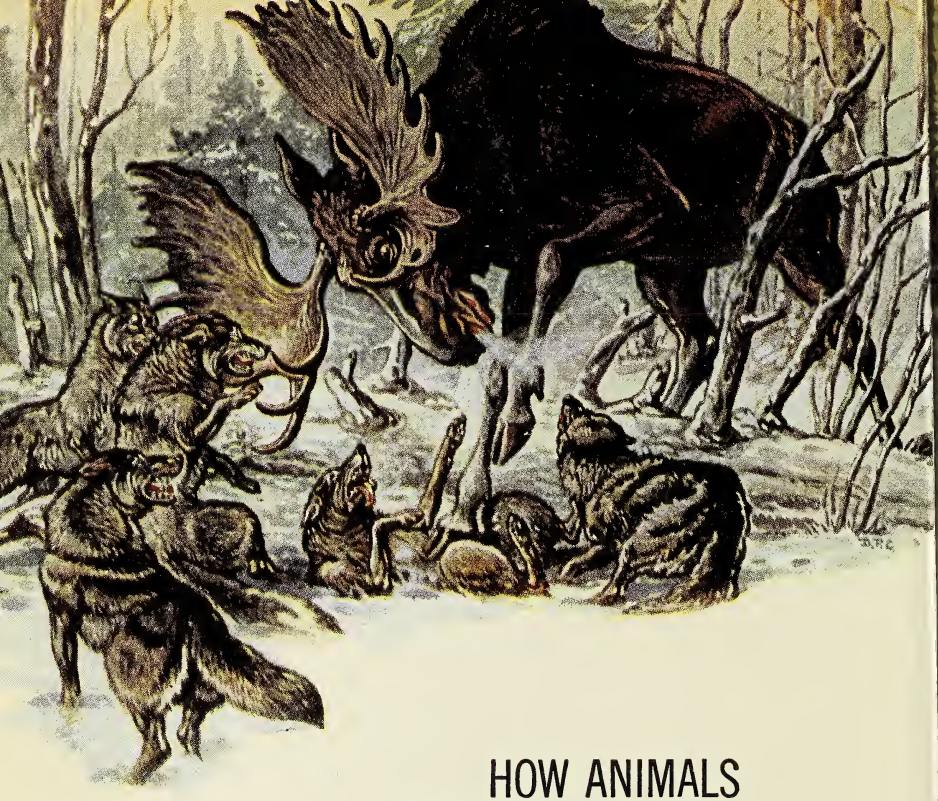
Part 2 HOW ARE LIVING THINGS PROTECTED?

A baby lion can move about easily to look for food. But there is something else he must be able to do to live in his jungle home. He must be able to catch other animals for food without getting hurt himself.

Most animals are in danger while they look for food. A rabbit looking for plants to eat may be caught by a fox. While the fox is hunting, he may be hunted by a man.

As you read, look for ways in which the rabbit and the fox can protect themselves from their enemies. Find out how the baby lion is protected until he is large enough to protect himself.

Plants, too, have enemies. They are eaten by many animals. They are often killed by cold weather. As you read, find out how plants are protected.



HOW ANIMALS DEFEND THEMSELVES

Why are the wolves in the picture fighting the moose?

How is the moose defending itself?

Tell what danger the wolves are in.

Animals have many different ways of defending themselves from their enemies. Pages 81 to 95 tell you what they are.

Three Enemies

Billy and Uncle Jim had fished all morning and were sitting by the creek eating lunch.

All at once something made a little splash in the water. A tiny fish was jumping above the water, trying to catch a white moth.

Just then Billy and Uncle Jim saw a big fish shoot toward the little one. There was another splash, and the big fish caught the little one and went swimming away.

At the same time Billy saw a swallow suddenly dart toward the creek. Flying low over the water, the swallow caught the white moth in its bill and flew away.

"Well!" cried Billy. "The fish and the swallow are having their lunches, too!

"I'm glad we don't have to get our lunch the way they do.

"I like to fish, but I wouldn't want to fly around catching moths to eat. Aren't you glad you're not a fish or a bird, Uncle Jim?"

If Billy could have followed the swallow a little way, he would have seen a hungry hawk diving through the air after it.

If he could have followed the fish, he might have seen a bear or a heron trying to catch it.

Most of the animals in the world spend a large part of their time looking for food. Many of them seem to be always hungry and hunting for other animals to eat.

So animals are always in danger of being killed and eaten by their hungry enemies.

Even the largest animals have enemies. A moose can be killed by several wolves hunting together, and wolves and bears are killed by men.

The smaller animals have many, many enemies.

What enemies does a fish have?

What enemies does a bird have?

Some Animals Can Fight

Almost all animals have some way of protecting themselves from their enemies.

Some animals fight their enemies. They have big horns or sharp tusks or other parts that they use in fighting and in defending themselves.

What did Old Tusk use to defend himself in the story on page 9?

How did the tiger fight Old Tusk?

What does a moose use to defend itself?

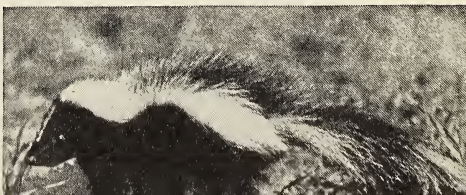
What does a cat use in fighting?

A bumblebee like this one can defend itself very well, even from large animals.

It can sting an animal that might try to hurt it.

Below is another animal that can defend itself. The black and white colors of the skunk seem to say, "Here I am. Watch out!" For most animals let the skunk alone.

When he is frightened, he shoots out oil that has a bad smell. Whatever that oil touches will smell, and smell, and smell! So the skunk is well protected from enemies.



Few animals will touch this porcupine.

All over its back and tail and sides are quills which are very sharp.

If you touched a porcupine with your hand, you would have quills sticking in it when you took it away!

An alligator, too, defends himself so well that other animals let him alone. His skin is so thick that an enemy would have a hard time biting him. Look at his picture below and tell why he might easily bite the enemy instead. Or he might strike it with his long tail.

The alligator often stays in the mud and waits for some animal to come near enough to be caught. His dark body looks like an old log. So other animals do not know that their enemy is near.

Look at the picture again and find an alligator in the mud. His eyes and nose are sticking up above the mud, and so he can breathe and see.

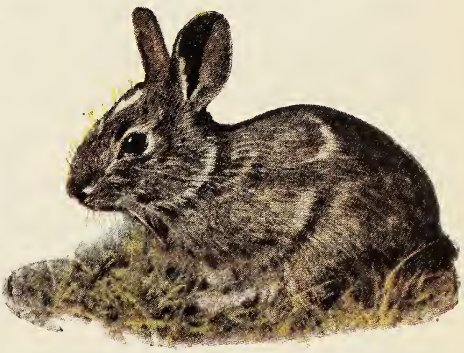
Some Animals Can Run Away

Many animals can run or fly or swim so fast that they may escape from their enemies. Even animals that can fight well sometimes run away instead of fighting.

What fighter ran away in the story of Old Tusk?

The rabbit in the picture below does not often fight, but he can run very fast. You can see him running in the picture on page 13.

What parts of his body fit a rabbit for running?

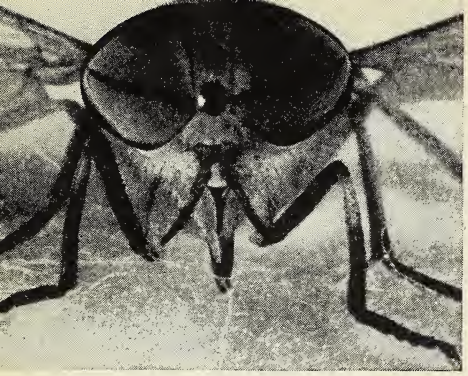


A rabbit can hear an enemy coming from a long way off.

Look at his long ears. They can hear sounds that your ears would never hear. So he can run away before his enemy comes too near.

The deer has long, strong legs which help him run very fast. If he knows that an enemy is coming near him, he can escape by running away.

Often the deer's nose tells him when an enemy is coming. He can smell a lion or a man from a long way off. So he runs away before the enemy can come too near him.



You know how hard it is to catch a fly.

Flies have eyes that see in all directions, and so they see their enemies in time to get away from them.

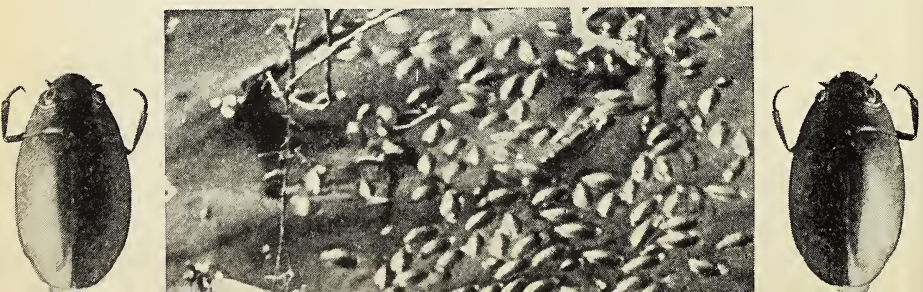
This picture shows the eyes of a fly many times larger than they really are. You can see a big eye on each side of the fly's head.

The picture below shows some other insects with eyes that protect them. They are whirligig beetles.

If you have seen these insects on top of a pond, you know how they get their name. They whirl around and around faster than you can see.

The eyes of these beetles see down into the water and up into the air at the same time.

If a fish comes along, the whirligig beetle can see him under the water and fly away. Or if a bird is overhead, the beetle can see him and dive deep down in the water.



Some Animals Can Hide

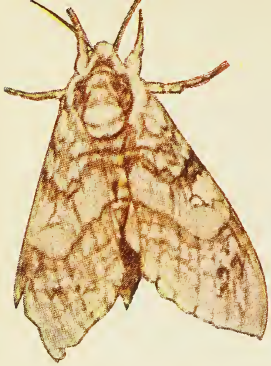
Here is an animal that can hide from its enemies. It is an octopus and lives in the water.

When the octopus is frightened, he shoots a dark brown ink into the water. The ink makes the water back of him as dark as night.

Then he moves back quickly into the dark water, and his enemies cannot see him.

The snail in the picture below has a different way of hiding. He has a hard shell on his back. When the snail pulls himself back into this hard shell, he is protected from birds and many other enemies.

What animals on page 35 have shells?



1

Many animals look so much like the ground or trees or grass around them that it is hard for their enemies to see them.

You can easily see the moth in Picture 1. The same moth is shown on a tree trunk in Picture 2. Can you see it easily there? Why?

How is this moth protected from birds when it is resting on a tree trunk?

The color of the baby deer in Picture 3 helps to hide him from coyotes, eagles, and other enemies. When he is lying under a bush, his coat looks like the ground, and the light spots on it look like spots of sunlight.

In the pictures below are two different kinds of bears.

The white bear in Picture 6 lives in the far north, where everything is covered with ice and snow. He is a polar bear.

The people who live in the north kill polar bears to use for food and to use their thick, warm fur for clothing.

The brown bear lives in the woods. Like the polar bear, he is hunted by people. They kill him to get his thick, warm fur and to keep him from killing their sheep.

As he walks along through the woods, his dark color keeps him from being seen easily.

Which is well protected for living in the woods, a brown bear or a polar bear? Tell why you think so.

How does the color of the polar bear protect him from hunters?

The color of the polar bear not only helps to hide him from his enemies, but it also helps him catch other animals for food.

The polar bear eats seals. He catches them by lying on the ice and waiting for them as they swim through the water. He looks like the ice and snow about him, and so the seals often do not see him in time to escape.

What animal in the story on page 9 was colored in a way that helped him get his food?

What animal on page 84 can get his food easily because he is the color of the mud about him?

Almost the only enemies that a big alligator has are men. They kill him to get his skin. How does his color protect him from men who hunt him?

Some animals change color when they move from one place to another. The horned toad on page 16 is very much the same color as the ground he is on. If he should move to a place where the ground was darker, he would look darker, too.

Wherever he goes, he changes to the color of the ground, and so he can hide from enemies.

Some frogs look green like the water plants around them when they are in marshy places. When they go on dry ground, their color changes to brown, and they look like the ground.

Some animals change color when the seasons change.

This big snowshoe rabbit is brown like the ground in summer. In winter he is white like the snow.

How does changing color hide him from enemies?

Animals do not always run away when they see an enemy. Sometimes they sit very still. Then, if they are colored like the ground or bushes around them, they are very hard to see.

While a rabbit is hopping about, a hawk or a fox can easily see him. But if he sees the enemy first, he suddenly stops moving and sits so still that we say he "freezes."

Look at the picture of the rabbit on page 85. How would "freezing" help him hide from a hawk?

When a prairie-dog comes out of his hole, he often sits very still at the edge of it for a little while. He "freezes" to look for danger before he leaves his hole.

If a coyote or a hawk happens to be near, the prairie-dog pops back into his hole.

Look at the picture on page 25 and tell why "freezing" helps to hide the prairie-dog while he looks for enemies.

Some insects can hide from their enemies because they look like something else.

In Picture 1 is an insect that looks like a twig! It is called a walking-stick.

Walking-sticks live on the branches of trees and eat the leaves.

Can you see the walking-stick on the twig in Picture 2?

How is this insect protected from birds when it is on a branch or twig?

Why is it hard to see the caterpillar on the twig in Picture 3?

When the caterpillar is frightened, it straightens out between twigs and "freezes." Then birds and other enemies cannot find it easily.

5

4

6

Do you think the insect in Picture 4 can protect itself? Tell why.

You may think this insect is a bumblebee, but it is not. It is a robber fly.

The robber fly has no sting and could not hurt you. But it looks like a bumblebee, and you think it is one. You let it alone, and so do birds and other enemies!

Pictures 5 and 6 show two kinds of butterflies. How can you tell them apart?

Birds will not eat the butterfly in Picture 5. They seem to know that it will not taste good.

The butterfly in Picture 6 would make a good dinner for any bird. But most birds will not eat it, either. Why do you think they let it alone?

Questions to Answer

1. When a dog frightens a cat, how does the cat defend itself?

2. How does an animal use these parts of his body to defend himself?

horns	legs	nose
stinger	wings	eyes
quills	ears	shell

3. Why is an animal protected if he looks like the ground or bushes around him?

4. When an animal "freezes" what does he do?

5. Name three animals that can hide by "freezing" and tell how their color helps them hide.

6. Name an animal that turns white in winter. How does changing color protect him from hunters?

7. Name two animals that change color when they move from place to place.

8. What two animals look so much like something else that they can escape from their enemies? What does each one look like?

9. Tell why looking like something else helps these two animals?

Things to Find Out

Watch the animals that you often see to find out what enemies they have and how they defend themselves.

1. When you touch a caterpillar, he seems to think he is in danger. Watch him to find out how he defends himself.

2. Find out if you can move your hand toward a fly from any direction and touch him before he sees you.

3. Find out if a turtle uses his shell to protect himself.

4. Many of the moths that you see are called "under-wing" moths. They have two lower or under wings that are brightly colored. They also have two upper wings that look like the ground or the trees where they are often found.

Watch an under-wing moth to find out what happens to the bright-colored wings when the moth lights on something. Tell how this protects the moth from a bird that might try to catch it.

5. Watch for frogs in a pond or marsh and find out if their color makes it hard for you to see them.

HOW HOMES PROTECT ANIMALS

What animal homes do you see in the picture? How does the squirrel's home in the tree protect him from the fox?

The bird in the picture is a meadow-lark. Her nest is made on the ground, but it protects the lark and her eggs from the fox. You will find out how it protects them when you read pages 97 to 111.

The Trap-door Spider's Nest

It was late in the afternoon, and Jim and his mother were taking a walk in the hills. After a while they sat down to rest.

Suddenly Jim's mother said, "Look!"

She was watching something on the ground.

At first Jim could not see anything but grass and soil. Then a beetle ran through the grass, and Jim watched it.

All at once a tiny door opened right up out of the ground beside the beetle. A big spider popped part way out the door, caught the beetle, and popped back into the ground! The tiny door dropped shut again.

"It's a trap-door spider!" said Mother. "Watch the door, and maybe we'll see her again. But don't move, or she won't open the little door."

Jim looked at the little door. When it was shut, it was just like the rest of the ground.

Suddenly it moved. The spider pushed it up a little, but not far enough for Jim to see her.

She was waiting inside her nest for another insect to come near the door.

Jim grew tired of waiting for her to come out.

"Let's look inside," he said.

When he moved, the door shut quickly. He tried to open it with his finger nails, but it stayed tightly shut.

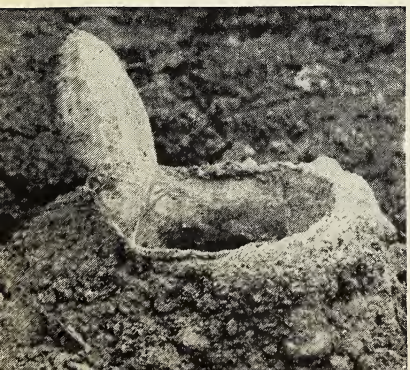
"It must be caught on something," said Jim. "It opened easily when the spider pushed it up."

Jim's mother laughed at him.

"You may as well give up," she said. "You will never get that door open while the spider is inside. She is holding it shut!"

If Jim could have looked under the little door, he would have seen a fine, safe nest. When the spider is in her nest, she is well protected from bad weather and from her enemies.

The spider makes her nest by digging a small, round, deep hole in the ground. She lines it with silky webbing that keeps it dry.



To make the door she sticks tiny pieces of moist earth together with silky spider webbing. She fastens one side of the door to the edge of the hole with webbing.

While the spider is making the trap-door, she sticks tiny rocks or grass on the outside of it. This makes the door look just like the ground around it.

She makes two little holes in the under side of the door. She uses these holes to hold on to the door when she is inside her nest. She can pull her door down and hold it shut.

While the door is still moist, she opens it and bangs it shut many times. This makes it fit tightly into the opening of the nest.

When the little door is finished, it shuts so tightly that not even rain can get under it.

The spider spends her whole life in her dry, safe nest in the ground. If she grows too large for her home, she comes out of the ground just long enough to make a larger one.

When the trap-door spider is hungry, she lifts her door and waits under it until an insect comes near. Then she pops out, catches the insect, and drops back inside as quick as a wink.

But she does not go all the way out of her nest. If she did, the little door would close, and she would be shut out of her own home.

Homes in the Ground

The trap-door spider's home in the ground hides her and keeps other animals out.

In the same way this fox family is protected by a home in the ground. We call their home a den.

There are three babies in this family, two red ones and a black one. The picture shows them with their father and mother near the tunnel into the den. The opening of the tunnel is partly hidden by a bush.

A fox hides the opening of its den back of a bush, log, or rock, so that enemies will not find it.

The doorway is just large enough for a fox to go through. A man or a big dog could not get in without digging a larger opening.

From the doorway of the den, a tunnel goes into the ground to a little room. This room keeps the baby foxes warm and dry in stormy weather.

The mother fox often brings the babies outside the den to play in the sunshine. But if a dog or a man comes near, or if an eagle flies overhead, she quickly takes them inside again.

The big foxes sometimes go a long way from home when they look for food. Then the baby foxes stay inside their den, where they will be warm and safe.

A fox often makes more than one tunnel into his den. If an enemy finds the front door and tries to dig the foxes out, they can go through the back door and get away!

How are the animals on pages 23 and 25 protected by their homes in the ground?

Animal Towns

Several families of beavers live in this pond, and their houses are like a little town. The beavers work together to make a safe place for their town.

They are safer in water than they are on land, for wolves, coyotes, and many other land animals cannot reach them in the water.

But the beavers cannot live in just any pond. They must live where food will be near them.

Beavers use trees for food. They cut down the trees with their strong, sharp teeth and eat the twigs and bark. So their pond must be in a place where there are many trees.

By working together, the beavers can build a dam and make their pond where they want it.

They find a place where a creek runs through the woods and build a dam across the creek.

The dam is built of branches, stones, and mud. After the dam is built, the water cannot run on down the creek. It spreads out and makes a deep, wide pond. Then the beavers build their houses.

The houses look like big piles of sticks and mud. The top of each house is above the water, and in this part is a room. The doorway into the room is deep under water, where land animals cannot reach it.

Every beaver watches carefully for danger. If he is on land and sees an enemy, he runs to the water, and all the other beavers follow him.

If the beaver sees an enemy when he is in the water, he lifts his wide, flat tail and brings it down on top of the water with a bang!

This sound says "Danger!" Quickly all the beavers dive into the deep water to hide. So the beavers help to protect each other by living together.

On page 105 the picture shows swallow nests built together like a town. If a hawk comes near, all the swallows fight him with their sharp bills. With so many swallows after him, the enemy goes somewhere else very fast!

Prairie-dogs live in towns and protect each other by watching for enemies. The picture on page 25 shows a prairie-dog looking for danger.

Prairie Lark Bluejay

How Nests Protect Birds

A bird's eggs and babies are always in danger, because cats, hawks, foxes, and other animals hunt them for food. The mother bird is in danger, too, when she is on the nest. So birds need to make their nests where they cannot easily be found.

The baby bluejays and their mother have a nest high in a tree. They are safe from enemies that do not climb or fly. And the branches and leaves of the tree hide them from cats and hawks.

The prairie lark makes her nest on the ground. Do you think enemies can find it easily? Why?

How is the meadow-lark's nest on page 96 hidden?

The oriole makes a deep nest like a bag and hangs it from the end of a branch. The mother oriole lays her eggs in the bag. While she sits on them, the deep nest protects her from her enemies.

Cliff swallows build their nests under the edges of high rocks. The swallows carry tiny balls of mud and stick them together to make the nests.

The rocks protect the nests from wind and rain, and the swallows' enemies cannot climb up to them.

Look at the eagles' nest on page 18 and tell how it is protected from enemies.

Animal Homes in Winter

In winter the bear makes his home in a cave or a hollow tree. Cold winds blow, and snow falls, but the bear does not know that. He sleeps through the winter in his warm, dry bed!

The bear's body must have food even though he is sleeping. In summer he eats a large amount of food and gets very fat. This fat is really food that keeps him alive while he is asleep in winter.

In spring, when the sunshine is warmer than it is in winter, the bear wakes up. After his long sleep his body is thin. Can you tell why?

Many other animals sleep all winter, but not all of them live in caves or hollow trees. Some of them just crawl deep into the mud at the bottom of creeks and ponds. Then they go to sleep and stay asleep until the warm sunshine wakes them up in the spring.

Turtles sleep in the mud all through the cold weather, and so do frogs.

Whirligig beetles crawl under old leaves or dig into the mud for their long winter sleep.

Many butterflies and other insects crawl into cracks in tree trunks or under old logs and go to sleep for the winter. Spiders do, too.

House flies often sleep in the walls around your windows. They sometimes wake up and come out on warm winter days. That is why you sometimes see flies in winter.

Chipmunks sleep during the winter in homes in the ground. They wake up once in a while but do not leave their homes until warm weather comes.

When the chipmunk wakes up on winter days, he does not need to hunt for food. He gets it from the storehouse in his home, where he has stored nuts, corn, wheat, and other food.

He eats all he wants and goes to sleep again.

The beavers store their winter food in the mud at the bottom of their pond. They cut the trunks and branches of trees into big pieces and make a pile of them under the water.

In winter they carry pieces from the pile into their houses and eat the twigs and bark.

Page 25 told you about another animal that has a winter storehouse. What animal is it?

Most birds do not have homes that protect them from the cold weather. During the winter months many of them live where the weather is warm. They spend the winter in the south.

When spring comes, they fly north to build their nests and hatch their young.

By fall the young birds have learned to fly and are big enough to take care of themselves.

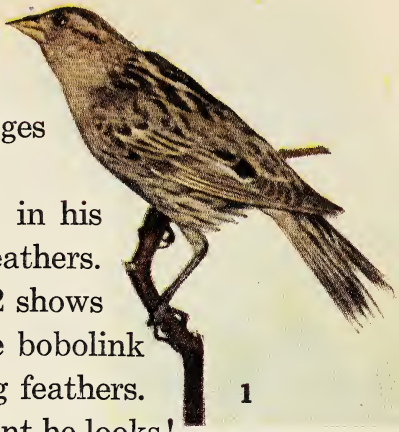
Then the old birds and the young ones fly to the warm south again. We say that they migrate.

The trip that the birds make is not an easy one. Their wings must carry them through storms and fog. Enemies are ready to catch them. They must find food. Some of them fly for hundreds of miles across water before they can eat or rest.

Orioles, bluebirds, robins, wild geese and ducks, and many other birds migrate.

The bobolink goes south every autumn. And he changes color before he goes!

Picture 1 shows a bobolink in his winter feathers. Picture 2 shows the same bobolink in his spring feathers. How different he looks!



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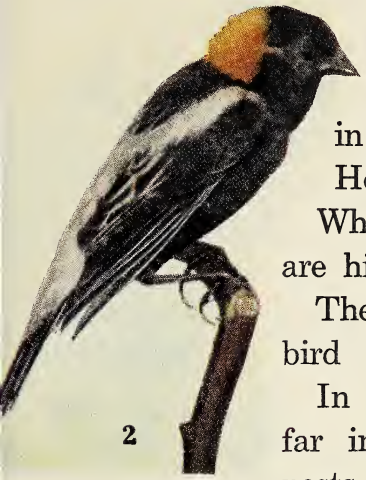


2

What are his winter colors? What are his spring colors?

The junco in Picture 3 is another bird that migrates.

In the spring the juncos migrate far into the north to make their nests and raise their young.

In the fall they come south again. But they do not fly as far south as the bluebirds, orioles, and many other birds.

They can live through cold weather if they have plenty of seeds to eat. So we often see juncos in cold weather, looking for seeds in the snow.

3

When birds migrate, some of them fly in the daytime, but many of them fly only at night.

Robins, bluebirds, orioles, bobolinks, and many others fly at night. In the daytime they rest and hunt for food in the fields, woods, and marshes.

Swallows fly both day and night. They feed upon insects, which they catch in the air as they fly. So they do not have to stop to find food.

Wild geese and ducks fly at night and during the day, too. They often stop to rest and look for food in lakes and marshes.

Birds that migrate always seem to know where to fly. They know which direction is toward the south.

Even young birds that have never gone south before seem to know just where to go. And they know which direction to take in the spring, to fly back to their homes in the north.

Some birds do not migrate but live in one place all the year around.

What birds stay here all winter?
What birds come here from the north?
Find out how they live in winter.

Questions to Answer

1. Why is it hard for enemies to get into the home of the trap-door spider?

2. How does a trap-door spider make her nest?

3. Why is the spider's nest hard to find?

4. How does the trap-door spider's home protect her from stormy weather?

5. Name two birds that build nests on the ground and tell why their nests are hard to find.

6. Name two birds that make nests in trees and tell how their homes protect them.

7. Why is it hard for enemies to get into a fox's den?

8. Why is it hard for the beaver's enemies to get into his home?

9. Tell two ways in which living in a town helps protect the beavers.

10. Name as many animals as you can that sleep in winter and tell what kind of winter home each one has.

11. What animals migrate? How are they protected from winter by being in the south?

HOW ANIMALS TAKE CARE OF THEIR BABIES

Have you ever watched an animal take care of her baby? What animal did you see? How did she protect her baby?

How did the mother hen take care of her chicks in the story about Waddles?

The picture shows some animal mothers and their babies. Pages 113 to 127 will tell you how the babies are protected.

How the Quail Fooled Dick

Dick had found a quail's nest in the meadow. In the nest were ten eggs that the mother quail was keeping warm.

In two or three days the baby quail began to hatch. They were much like little chickens.

Almost as soon as they hatched, they could run about over the ground. How fast they ran to Mother Quail when she called them to eat food she had found for them!

They were the same color as the dried grass and leaves on the ground about them. A fox, hawk, or other enemy might never see them unless they were moving.

The baby quail soon learned to "freeze" when Mother Quail's call said "Danger!" Each little chick would stay very still wherever it happened to be. Not a head or a foot would move.

One day Dick saw Mother Quail near the edge of the woods. He knew her babies were somewhere near, and so he started to look for them.

Suddenly he saw that something had happened to the mother bird. Her wing seemed to be broken. It touched the ground as she ran ahead of Dick.

Dick followed the quail. "Don't be frightened," he said. "I will catch you and take you to Father. He will take care of your broken wing."

But no matter how fast Dick went, the quail went a little faster.

At last Dick thought, "I must stop, or she will be so far from her babies that she will never get back to them."

Just then Mother Quail flew into the air. Her wing was not broken at all!

Dick laughed and laughed. "You fooled me that time," he said. "You have taken me a long way from your babies, Mrs. Quail. Did you think that I might hurt them?"

But Mother Quail did not hear Dick. She was hurrying back to her babies as fast as she could.

Some Babies Take Care of Themselves

As soon as the quail babies hatched from the eggs, they were able to run about with their mother and look for food.

At first they stayed with their mother. She protected them and helped them find food.

But in two or three months they could take care of themselves. They were almost as large as she was and did not need her care.

Grasshopper babies have no care at all from their mother.

In the fall the mother grasshopper makes a hole in the ground and lays her eggs in it. Then she covers the eggs with soil, and so they are protected from enemies.

In the spring out come the baby hoppers. They can take care of themselves as soon as they hatch.

They can move about and find food. They can hop away from their enemies in long jumps.

They never see their mother, and they do not need her care.

Of course, many young grasshoppers are caught by birds and other animals. But so many, many grasshopper babies are hatched every spring that some of them always grow to be big grasshoppers.

Another animal that grows up without any care from its mother is the turtle.

A mother turtle digs a hole in sand at the edge of a river or a lake and lays her eggs in the hole. She covers the eggs with sand and leaves them there to hatch.

When baby turtles hatch from the eggs, they dig out of the nest by themselves.

The picture shows some baby turtles hatching from eggs.

The babies begin to crawl about at once. They can move on land and swim in the water to find their food.

Each little turtle is protected by the shell that has already grown on his back.

He never sees his mother, but he gets along quite well without her.

These young trout hatched from eggs. The mother trout laid the eggs on the bottom of a creek and covered them with pebbles. Then she went away and left them.

When the trout eggs hatched, the little trout did not need their mother. After a few hours they could swim about and find their own food.

The stickleback is a tiny fish that makes a nest for its eggs.

The father stickleback makes the nest out of tiny, soft water plants. He sticks the plants together with glue that comes from his body and sticks the nest to the stems of larger plants.

Mother Stickleback lays her eggs in this nest and swims away. But Father Stickleback stays near by and protects the eggs from other fish.

As soon as the baby fish are hatched, they can get their own food. They swim away, and the father and mother never see them again.

Fish, frogs, and toads lay a great many eggs. Many of the eggs and babies are eaten by other animals. But some of the babies live and grow.

Some Animals Protect Their Babies

How many babies did Mother Quail have? How large a family did the mother trout have?

Most animals that have hundreds of babies do not take care of them. But animals that have only a few babies take care of them until they grow up.

A mother alligator makes a large nest on the ground near water. In her nest she lays twenty or more eggs and covers them with leaves.

The mother stays near by to watch her nest. In about two months the baby alligators hatch. They make a squeaking sound, and the mother digs away the top of the nest so that the babies can get out.

Baby alligators can find their own food. But the mother protects them from enemies. She is ready to kill any enemy that comes near.

Does a mother robin have a large family?

How does she take care of her babies?

Baby robins are very helpless for the first few days after they hatch from the eggs.

They cannot move out of their nest.

They have to be fed and protected by their parents.

But after about two weeks they are large enough to learn to fly. It is several days more before they are able to fly easily and get their own food.

If there were as many babies in a bird family as there are in a trout family, do you think the parents would be able to take care of them all? Why do you think so?

The skunk babies in the picture below are cared for by their parents for several months. The big skunks dig a den or make a nest of grass and leaves in a hollow log, and there the babies are born.

For about twenty days the skunk babies are very helpless. Their only food is milk that they get from their mother. When they are strong enough to move about and play outside the den, their parents bring mice and other food to them.

Soon Mother Skunk takes them for walks and teaches them to catch their own food. Then they can learn to take care of themselves.

Along through the woods they go, Mother Skunk first and her babies in a line after her. If a young skunk starts off in another direction, his mother runs after him and quickly gets him back in line with the other babies.

She is a fine mother and does not let her babies go their own way until they are large enough to take care of themselves!

Opossum babies stay with their mother until they are quite large. She protects them and helps them find food.

When opossum babies are first born, they are very tiny and very, very helpless. They cannot see or move about on the ground, and they have no hair at all. Their mother must protect them from cold and rain and from their animal enemies.

The mother opossum has a pocket on the under part of her body. The babies stay in this pocket for the first two months of their lives. Here they are kept warm and safe. During this time they are fed by milk from their mother's body. Hair grows on their bodies, and their eyes open.

When the opossum babies are large enough to leave the mother's pocket, they take rides on her back.

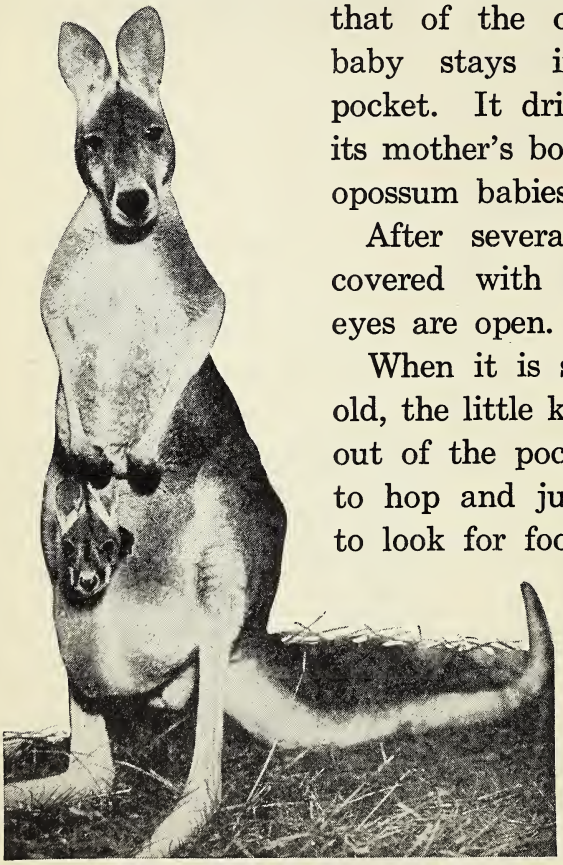
After a while they run about on the ground to look for fruit, small animals, and other food.

But they still do not go far from the mother opossum. When danger comes, they take tight hold of her long fur, wind their tails around her tail, and ride away from the enemy.

A kangaroo mother often has just one baby at a time.

Her baby is very tiny at first, and it has no hair at all. Its eyes are shut, and it cannot hop as its mother can. So it needs much care.

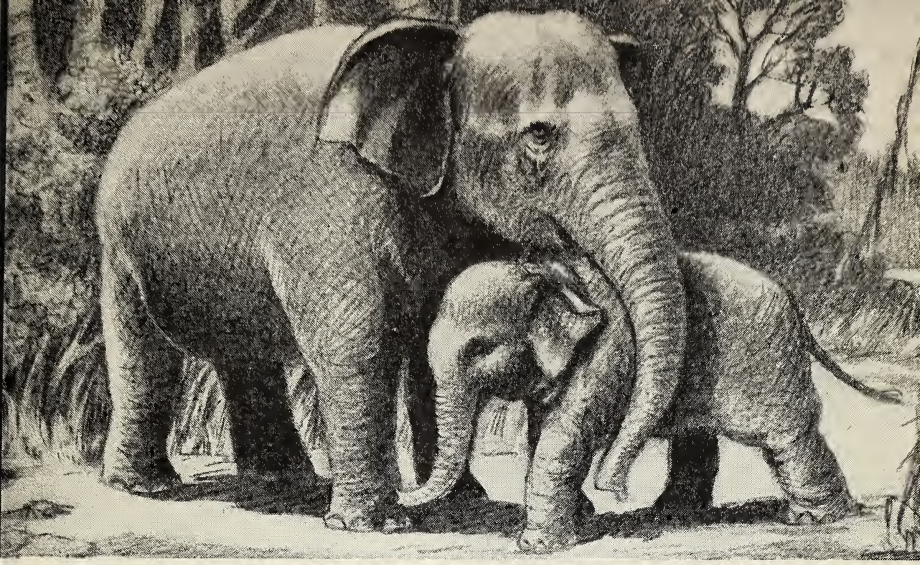
The kangaroo mother has a pocket very much like that of the opossum. Her baby stays in this warm pocket. It drinks milk from its mother's body, just as the opossum babies do.



After several weeks it is covered with hair, and its eyes are open.

When it is several months old, the little kangaroo climbs out of the pocket and learns to hop and jump. It learns to look for food, too.

But it stays close to its mother. When danger comes, it climbs right back into the pocket!



A mother elephant has just one baby at a time. While it is very young, she gives it much care. She lets it walk under her body to protect it from danger. She washes it by shooting water over it with her trunk.

The baby gets milk from its mother for about two years, and the mother protects it and takes care of it for five or six years longer.

A baby elephant cannot use its trunk very well until it is several months old. Then the mother elephant teaches it to drink water with its trunk and to use its trunk in other ways.

The other elephants in the herd help protect the babies. Look at page 9 and tell how the big elephants helped protect the young elephant calves.

The mother lion in the picture has only one baby, but there are often three or four babies in a lion family.

Lion babies look much like kittens.

The mother carries them as a cat carries her kittens.

She picks them up in her mouth. She does not hurt them, for she takes hold of the loose skin at the back of their necks.

While her babies are still very young, the mother lion starts teaching them how to protect themselves and how to hunt for their food. But the young lions stay with their mother for two years or longer. She protects them until they are large enough to take care of themselves.

What animal have you seen taking care of her babies?

How many babies did she have?

What care did her babies need?

Do you know what baby needs the most care and stays with its parents for years and years before it is grown up?

That baby is you!

The baby in the picture is a year old. When many animal babies are that old, they are as large as their mother and can take care of themselves.

But this baby is just learning to walk. He was very, very helpless when he was first born. For many months he could not stand up, and so his mother carried him or wheeled him in a buggy.

She feeds him and washes him, puts him to bed at night, and dresses him in the morning. She takes care that he does not fall or get too warm or too cold. It will be years before this baby can do all these things for himself.

How old are you?

How do your parents take care of you?

Questions to Answer

1. Which of these mother animals feed and protect their babies?

grasshopper	elephant
kangaroo	quail
turtle	robin
trout	opossum

2. Which of the animals above have very large families and which have small families?

3. Which mother animal feeds and protects her babies, one with a very large family or one with a small family?

4. Name the baby animals in the picture on page 112. Which of these babies are fed and protected by their mother? Tell why you think so.

5. Why is a fish the enemy of a swallow? Why is a swallow the enemy of a moth? Why is any animal the enemy of another animal?

6. Tell what enemies each of these animals has and how the animal is protected.

rabbit	whirligig beetle	snail
bee	polar bear	fly

Things to Find Out

Your book has told you some of the ways in which animals are protected. If you watch the animals around you, you may be able to find out other ways in which they escape from their enemies.

1. Write down the names of all the animals you see in one week. Find out if any of these animals are the enemies of each other.

2. How are these animals protected from their enemies?

3. Look for the homes of animals and find out how each home protects the animal that made it.

4. Flies are your enemies. Find out why.

5. What other insects are your enemies? What other animals are your enemies?

6. Find out how your home protects you from animal enemies. How do you defend yourself from these animals?

HOW PLANTS ARE PROTECTED

Plants are often in danger just as animals are.

Think of the plants that grow in your garden and the plants that grow in a field where animals feed. What enemies do you think these plants might have?

Pages 129 to 137 will tell you how plants are protected.

How Plants Are Protected from Animals

If you should walk in a field where cows and sheep are feeding, you would see that they have eaten the grass close to the ground.

But you might find some milkweeds and thistle plants that the animals have not eaten. These plants are protected against such animals as cows, sheep, and horses.

This picture shows how a thistle is protected from being eaten by animals.

Look at the thorns on its stems and leaves. These thorns cover the whole plant.

Look at the cactus plant on page 57 and tell how it is protected from animals.

The picture on the left-hand page shows milkweed plants. In each plant is a white, bitter juice. No matter where you cut into the milkweed plant, you will find this juice.

Animals soon learn that the milkweed plant has a very bitter taste. So they leave this plant alone, and the milkweed plants grow and make seeds each year.

Another plant that is protected by a bitter taste is the dandelion. Not many animals will eat a dandelion.

Dandelions are protected in another way. If an animal should eat the top of a dandelion plant, new leaves and stems will grow from the roots.

Have you ever tried to keep dandelions out of your yard? Then you know how quickly the new leaves and stems can grow!

In the same way, grass will grow again and again. Every time you cut the grass you cut off part of each blade. But the blade soon grows up again.

We make our yards pretty by keeping the grass cut short and smooth. So it is a good thing that grass can be cut without hurting it.

But when dandelions and other weeds grow again and again from the same old roots, we often wish that they were not so well protected!

Weeds are almost always well protected, and so it is usually very hard to keep them from growing in our fields and gardens.

How Plants Are Protected from Weather

One of the greatest enemies that plants have is the weather.

Storms often tear the plants to pieces.

If the weather is too cold, the plants may freeze and die.

In hot weather or very dry weather the plants may lose so much water that they will die.

When you were reading about land plants in Part One, you learned that they are protected against losing too much water. They have skins that help them keep water.

You found out on page 58 that the skins of cactus plants protect them in the dry desert.

The bark that covers most trees is waterproof, and so trees lose water only through their leaves.

In summer many trees lose a large amount of water through their leaves. This does not hurt them if their roots take in water faster than the leaves lose it.

But in winter the water in the soil sometimes changes to ice and will not go into the roots of the trees. If the leaves of a tree should lose water in winter when the roots cannot take it in, the tree would die.

In autumn the leaves of the maple tree change color and fall to the ground. The tree has no leaves in winter. So it does not lose water through its leaves in winter.

Trees that lose their leaves in autumn have tiny buds growing on their branches all summer long. The right-hand picture below shows you how maple buds look when autumn comes.

Each bud has several tiny leaves inside a tight, brown covering. This covering protects the leaves from cold during the winter.

When spring comes, the roots of the trees begin to take in water again. Then the tiny leaves in the buds begin to grow. They break open the tight covers and spread out in the sunshine.

So each spring the trees have new green leaves!

The trees in this picture are called evergreens because they are always green. They do not lose their leaves in winter.

The leaves do not freeze, and so they live through the winter.

The leaves of these trees are long and thin. We call them "needles."

Needles have a tight hard skin that is covered with a sticky glue. Water cannot go through this skin easily. So trees with needles are protected from losing water too fast in winter.

Trees cannot make food after their leaves have fallen. But they have food stored away in their roots, trunks, and branches. This food keeps them alive through the winter and makes new leaves grow in the spring.

On page 130 you learned that a dandelion's roots can grow new stems and leaves if the old ones are cut off.

In winter the stems and leaves die, but the roots stay alive.

There is food stored in the roots, and in the spring new leaves and stems use this stored food and grow up from the roots. So the plant does not die, but grows again each year.

When the top of a potato plant dies in the fall, the whole plant does not die. In the ground are potatoes it has made. These potatoes are filled with stored food and can live through the winter.

They are taken out of the ground in the fall. Some of them are used for food, and some are planted in the spring.

When potatoes are put in the ground in the spring, new leaves and roots grow from them. The new leaves and roots will make new potatoes. So each spring new plants grow from a part of the old plant that does not die.

Some plants can grow again each spring because they make bulbs. A bulb is a new stem with new leaves wrapped tightly around it.

Food is stored in the bulb.

Bulbs grow on the plant's roots, under the ground. They can live in the ground all winter.

In the spring roots grow from the bulb, and the leaves and stem grow up into the sunlight.

Name some plants that grow from bulbs.

Many plants grow each year from seeds. Every seed has inside it a tiny baby plant and enough food to make the new plant start to grow.

Each seed is covered with a tight, hard coat that protects the seed from cold as it lies in the ground during the winter.

Pasque Flowers

Hepaticas

The pasque flower grows early in the spring when the weather is very cold. It often comes up while snow is still on the ground. But when the pasque flowers come up, the buds and stems are well protected by a fuzzy covering. So the plant lives, and the flowers can make seeds.

Hepatica flowers also come up in early spring. They are protected by a fuzzy covering, which you see in this picture.

Ferns

Skunk Cabbage

The tips of young fern leaves are easily killed by cold weather or by winds and rain. But when ferns first come up, the tips are protected. Each leaf is curled up in a tight roll with the tip inside.

Skunk cabbage grows early in the spring. The flower has a thick outside part that curls around the blossom and protects it from cold winds.

The leaves of the bloodroot below protect its flowers from cold weather, for each bud is wrapped in a leaf. Later the flower grows higher, opens out, and makes seeds.

Questions to Answer

1. Look at pages 48 and 49 and tell why we want plants like those in the pictures to keep on growing.

2. Why do we like to have trees growing near our houses?

3. Name some kinds of trees that have fruit which we eat.

4. Tell what we use in our homes that is made of wood. In what other ways do we use wood?

5. Tell how trees are fitted to live on land.

6. Tell two ways in which trees are protected from losing too much water in winter.

7. Why is cold weather an enemy of plants?

8. Name three flowers that come up early in the spring. Tell how these flowers are protected from the cold.

9. Name the plants that are in the pictures on pages 52 and 53. Tell how they are fitted to keep on growing even when no one takes care of them.

10. Name two plants that are protected from being eaten by animals and tell how each one is protected.

Things to Find Out

Watch the plants about you to find out as many things as you can about the ways in which they are protected.

1. Name some plants that grow in your schoolroom and find out how new plants can grow from them.

2. Write the names of some flowers that grow in your yard. Find out how the seeds of these plants are protected. Find out how the seeds can be scattered.

3. Name some flowers that grow in the woods. Find out what would happen if the roots of these flowers were pulled out of the ground.

4. Name three kinds of trees that grow near your home. Find out how each kind of tree is fitted to keep on growing.

5. Name two kinds of plants that grow in your yard. Find out if they grow from seeds each spring or if they grow from a part of the plant that does not die in the fall.

6. Find out what plants about you are weeds, and how they can be kept from growing.

How Living Things Are Alike

Name an animal that lives on land, and tell what he eats and how he gets his food. In what ways is this animal like all other animals that live on land?

Name a water animal and tell in what ways he is fitted to live in water. In which of these ways is he like other water animals?

How are animals alike that live both on land and in water?

Name a land plant and tell how it gets its food. How is it like other land plants?

How are water plants alike?

What animals have enemies? What animals are protected from their enemies?

What plants have enemies? Tell in what ways they are protected.

Look at pages 57 and 84 and find an animal and a plant that are protected in the same way from animal enemies. How are they protected?

How are animals alike?

How are plants alike?

Tell as many ways as you can in which animals are like plants.

How Living Things Are Different

Name an animal that flies in the air and tell how it is different from other land animals.

How is an earthworm different from a squirrel in the way it breathes? Tell other ways in which these two animals are different.

Name a land animal and tell how it breathes.

How is this different from the way in which a water animal breathes?

Tell as many other ways as you can in which land animals and water animals are different.

How is a chicken different from a duck?

How are water animals different from water-land animals?

Tell as many ways as you can in which land plants are different from water plants.

Look at pages 107 and 133 and find an animal and a plant that are protected in different ways against cold. How is each one protected?

Tell as many ways as you can in which plants are different from animals.

Part 3 THE EARTH'S SURFACE

Ships and airplanes go all the way around the earth. So we know that the earth is round. It is shaped like a ball.

The balls you play with are about ten or twenty inches around. But the earth is 25,000 miles around.

Think of a ball as large as that!

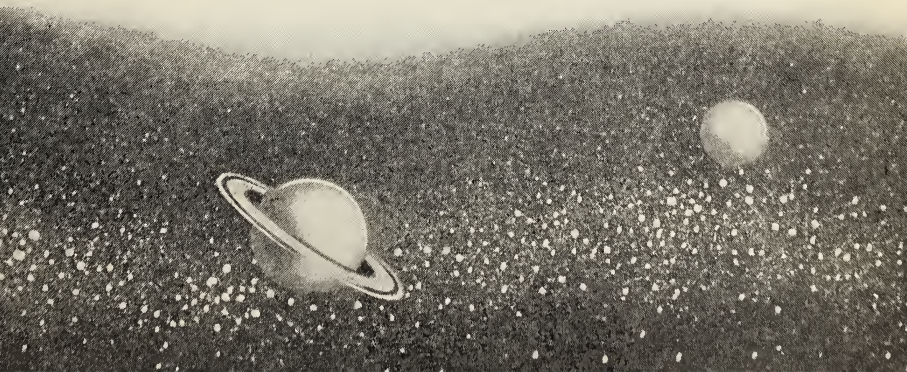
We live on the outside of the earth. This outside part is called the earth's surface.

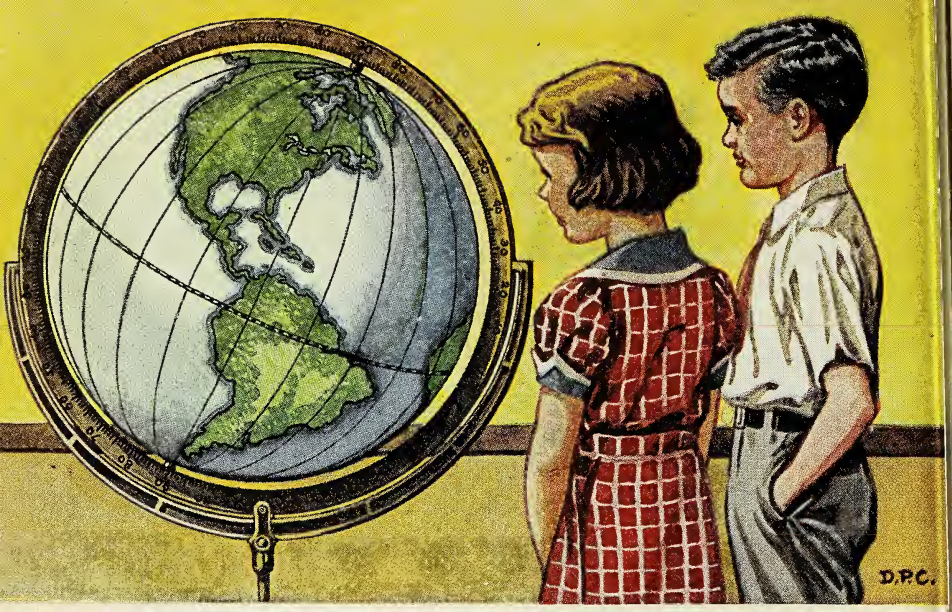
Part of the surface is land and part is water.

Under the land and water there is rock.

Sometimes the rock sticks up above the water. On land the rock often shows above the soil.

The earth's surface spreads out around you in all directions, north, south, east, and west. As you read, watch to see what your book tells about the part of the earth's surface where you live.



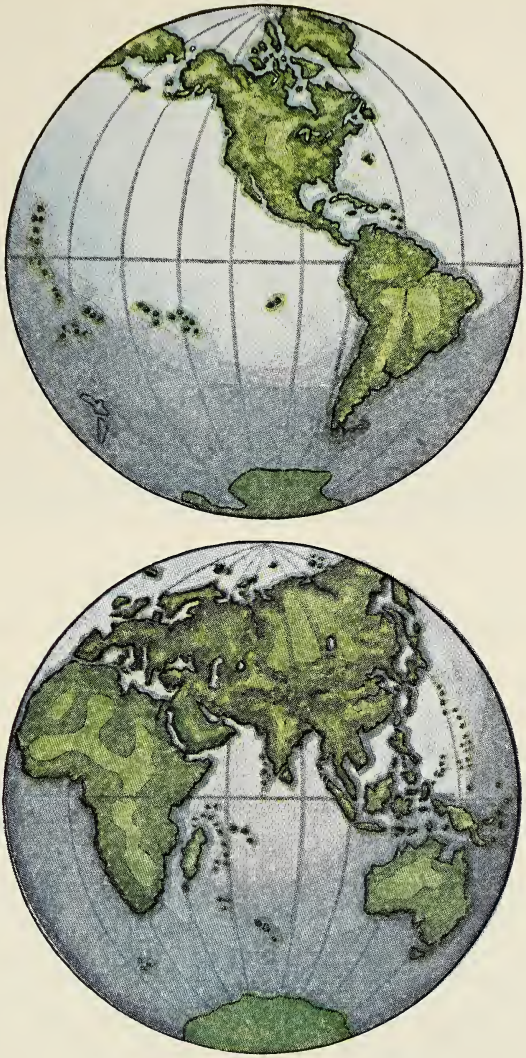


THE LAND AND WATER ON THE EARTH

The children in the picture are looking at a big ball called a globe. This globe shows the shape of the earth. It also shows the land and water on the earth.

The green parts of the globe show the land. The blue parts show the water.

The pictures on page 145 show both sides of a globe. Look at the two sides of the globe. Is there more water than land on the earth's surface?



How the Land Looks

We cannot see very much of the earth from where we live. But pictures can show us what the different parts of the earth look like.

The picture on this page shows how far you could see if you were on this farm. You could see a mile or two in each direction.

But if you should go up in an airplane, you could see many miles in each direction.

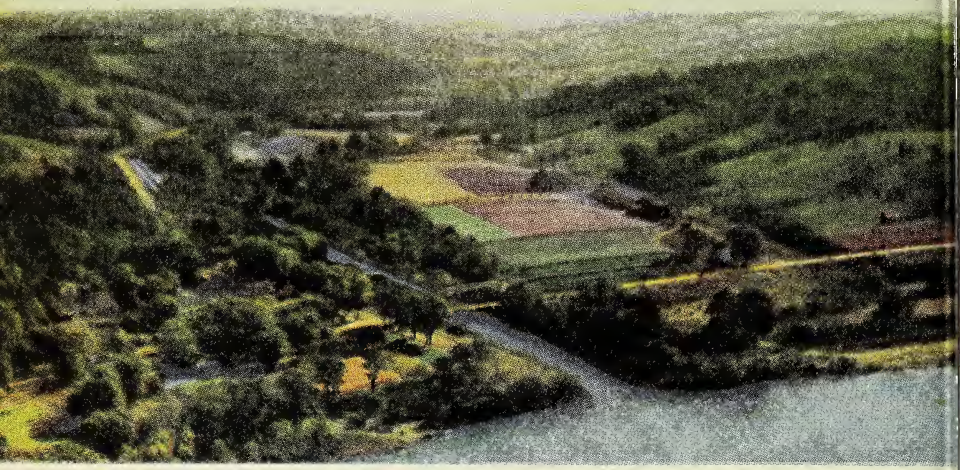
The picture at the top of page 147 was taken from an airplane. It shows a much larger part of the earth's surface than you can see from the ground.

Tell all the things you see in this picture.

Now look at the picture below. It shows the same part of the land as the top picture.

But it does not show everything on the ground. It shows only the high parts and low parts of the land.

This kind of picture is called a map. Find the high parts of the land on the map.



The low land between the hills in the picture above is called a valley.

The valley is narrow, but there is room for a few farms in it.

Some valleys are even more narrow than this one. And some valleys are very much wider.

The picture below shows a valley that is several miles wide.

There is room for many farms in this valley.

In almost every valley there is a stream of water.

Find a stream in each of the two valleys on the left-hand page.

Below is a map of the land in the picture at the bottom of the left-hand page

Find the hills in the picture.

Find the hills on the map.

Find the valley in the picture.

Find the valley on the map.

Find the stream on the map.

Do you live in or near a valley? Is there a stream in it?

You can make a map on your sand-table that shows a valley.

Make a wide valley with farms in it. Pile up the sand to make hills. Use a long piece of blue paper for a stream of water.

The highest parts of the earth's surface are called mountains. Find the mountains in the picture above.

Lower down are hills. They are called foothills because they are at the foot of the mountains.

Mountains and hills are usually together in a row many miles long. A row of mountains is called a range.

Sometimes a range of mountains is hundreds of miles long.

The tops of the mountains in this range are very high and pointed. They are called peaks. Mountain peaks are often bare rock with no soil at all.

In the winter these mountains and foothills are covered with deep snow. Even in the summer it is so cold on the high peaks that the snow does not all melt.

The map at the bottom of this page shows the same mountain range as the picture at the top.

The high mountains on the map are darker than the foothills.

Find the high mountains.

Find the foothills.

Find the highest peaks in the mountain range.

Plains are land that is very flat. The Great Plains, which are hundreds of miles wide, are in the United States.

The picture above shows a part of the Great Plains where there are many fine farms.

The brown part of the map below shows where the Great Plains are.

Do you live in the Great Plains?

Have you ever taken a trip through them?

Some places on the earth's surface have very little rain. So they are very, very dry. These dry places are called deserts.

The top picture shows a desert that has low hills of loose sand.

At the bottom of the page is a picture of another kind of desert. The soil is hard and has many stones in it.

Cactus and a few other plants that do not need much water grow in this desert.

The yellow spots on the map on page 152 show where the deserts are in the United States.

The top picture shows land that is very soft and wet. If you should try to walk through it, your feet would go down into mud and water.

Land like this is called a marsh or swamp.

There are two places on the earth's surface that are always covered with snow and ice. These places are the land near the North Pole and the land near the South Pole.

The top of the globe on page 145 is the North Pole. The bottom of the globe is the South Pole. Look at page 145 and find the land near the North Pole and near the South Pole.

Questions to Answer

1. Which are higher, mountains or hills?

2. What is a valley?

3. Tell what a marsh is.

4. Which words tell what part of the land you live in?

the hills	the plains
a wide valley	a sandy desert
the mountains	a narrow valley
a marsh	a rocky desert

5. Find a picture in this book that shows the kind of land near your home.

6. Are there many living things in the desert? Tell why.

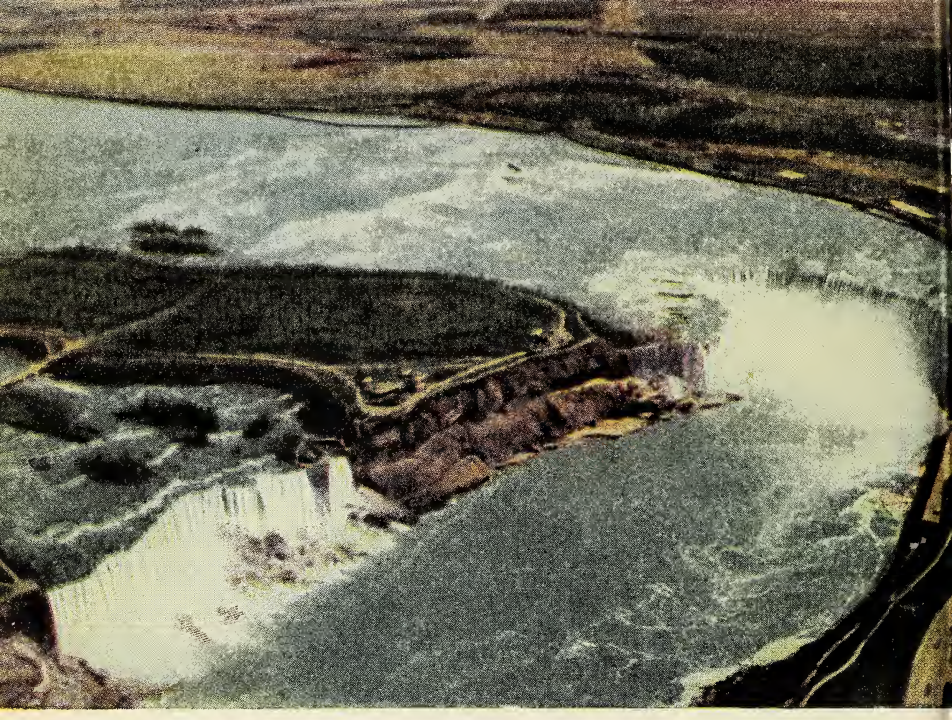
7. Is a marsh or swamp a good place for people to live in? Why?

8. What animals can live in a marsh?

9. Is it easy for people to live at the North or South Pole? Tell why.

10. What animals can live where the land is covered with ice and snow?

11. Would the bare rocks of high mountain peaks be a good place for people to live? Why?



The Water Parts of the Earth

In the maps on page 145 you saw that there is water all around the land on the earth. This water makes five great oceans.

On the land there is water in lakes and ponds. And water moves across the land in streams that we call creeks and rivers.

The picture shows water flowing fast in a river. What a loud noise the water makes as it falls to a lower place! We call this a waterfall.

Is there a river near your home? Watch it to see if the water moves.

A River Postman

"One, two, three, throw!" sang out Mr. Stone.

Splash! went ten bottles into the river.

Down they went! Then up they bobbed to the top of the water and started to float down the White River.

In each one was a letter to the finder of the bottle.

The letter said: "I would like to know how far the water will carry this bottle. Please write and tell me where you find it."

At the end of each letter was a boy's name and the place where he lived.

The river was flowing fast. So the bottles were soon out of sight.

The boys tried to guess how long it might be before they would learn where the bottles went.

Jim said, "Some of the bottles may be found in the Wabash River, for White River runs into it."

"The Wabash River runs into the Ohio River," said Dick. "So some of the bottles may be found in the Ohio."

"Well," said Jim, "the water in the Ohio River runs into the Mississippi and at last gets to the ocean. Some of the bottles may go that far."

"They may even go farther than that," said Billy. "Maybe the ocean will carry them to China."

John laughed and said, "If anyone in China finds a bottle, he can't read the letter in it, for he won't know the words."

The boys waited and waited. Two weeks went by. The boys were home from the woods, and still no letter had come, telling about finding a bottle.

At last a letter came for Dick, saying that his bottle had been found. A man had found it while he was fishing near the place where White River runs into the Wabash.

"My bottle didn't get very far," said Dick.

"It's only twenty miles to the Wabash River from where the bottles started on their trip."

It was three more weeks before another letter came. This time John's bottle had been found.

The letter was from a town on the Ohio River. A boy had found the bottle while he was digging for clams in the mud along the river.

"Well!" said John. "My bottle has traveled a long way! Let's find out how far it has gone."

The boys looked at a map of the United States and found that the bottle had traveled more than a hundred miles.

At Christmas time Joe had a letter. His bottle had been found in the Mississippi River.

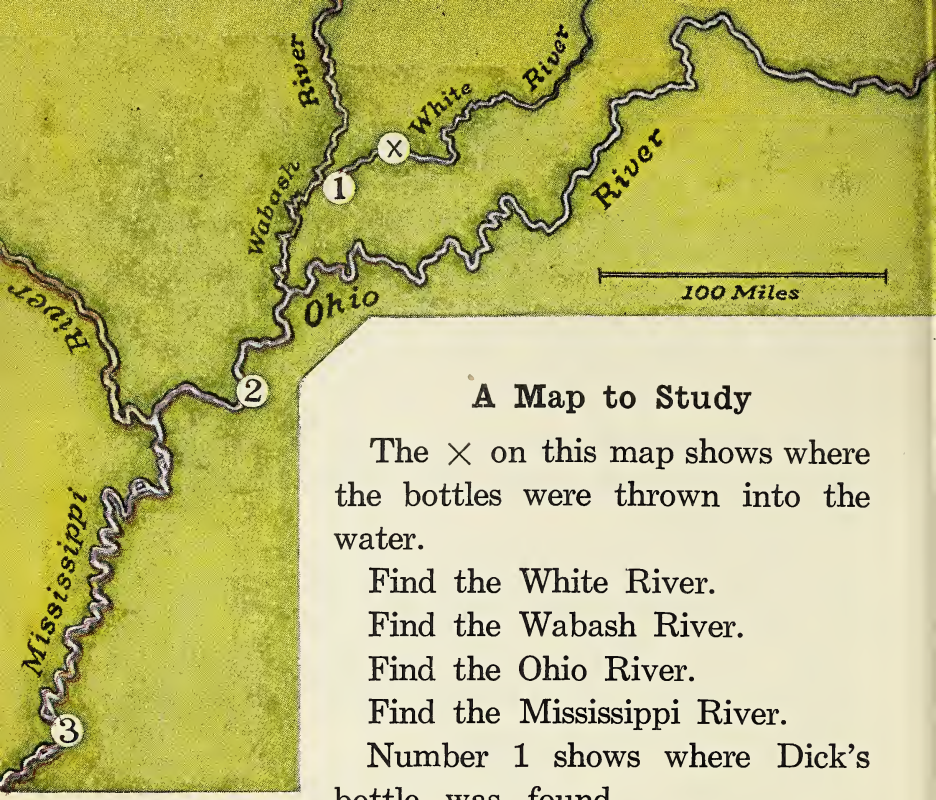
"My bottle almost got to the ocean," said Joe.

Weeks passed, but the other boys did not hear anything about their bottles.

"It has been six months since we put them into the river," said Jim. "Maybe the other bottles have gone across the ocean to China or some other land."

"I don't think we will ever find out where they went," said John.

And to this day they never have.



A Map to Study

The × on this map shows where the bottles were thrown into the water.

Find the White River.

Find the Wabash River.

Find the Ohio River.

Find the Mississippi River.

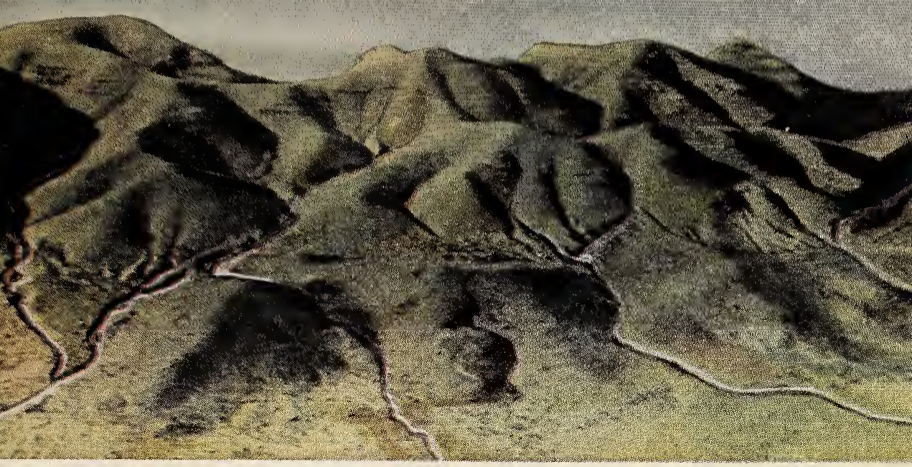
Number 1 shows where Dick's bottle was found.

John's bottle was found where you see Number 2. Number 3 shows where Joe's bottle was found.

The straight line on the right-hand side of the map is a measuring line. It shows one hundred miles on the map.

Can you tell by the measuring line on the map about how far John's bottle traveled?

Can you tell about how far Joe's bottle traveled?



Where Rivers Begin and End

This picture shows how some rivers begin. The place where a stream begins is called its head.

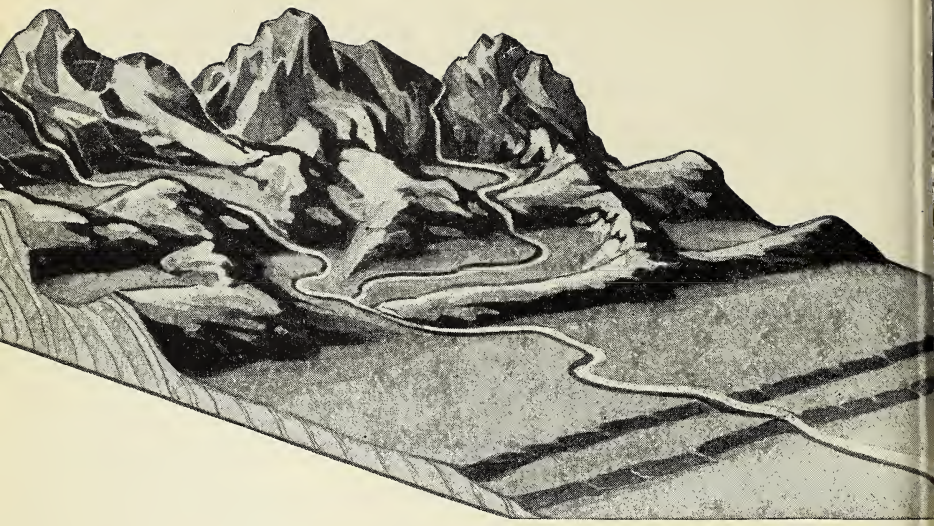
Many streams begin in the mountains. As the snow melts, the water makes little creeks. The creeks run down the sides of the mountains and the hills.

Several creeks run together and make one larger stream. Other creeks run into this stream as it goes along, and it becomes large enough to be called a river.

Rivers get larger and larger because other streams run into them.

On and on flow the big rivers until they empty into an ocean.

The place where a stream empties into another stream or into the ocean is called its mouth.



Where is the head of the river on this map, in the high land or in the low land?

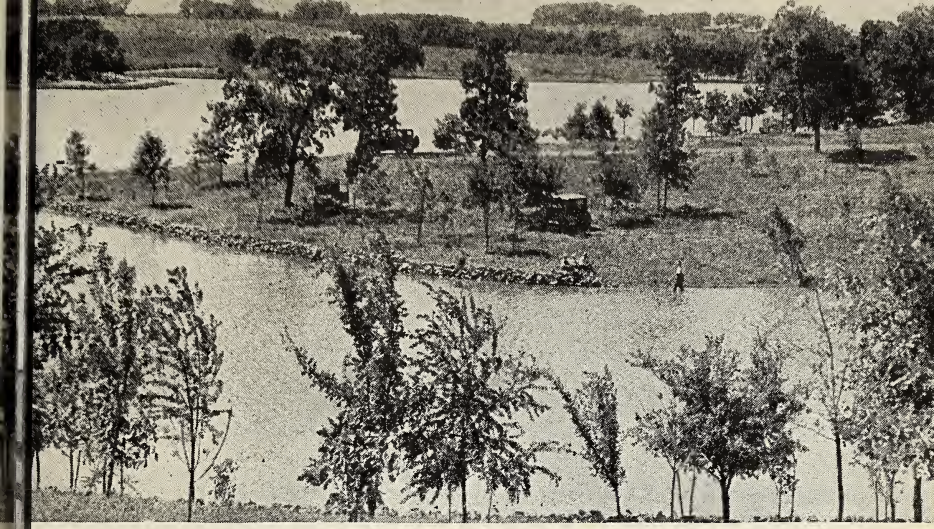
This map shows that the stream runs down from the mountains into the valleys and on down into the plains.

On and on goes the river through the low land, until it empties into the ocean.

Streams of water always flow down from the higher places in the land to the lower places. They always flow downhill.

If there is a river near your home, find out where its head is. Find out where its mouth is.

Watch it to find out if it flows downhill.



The land along the two sides of a stream is called the banks of the stream.

What do you see on the banks of the stream in the picture above?

Sometimes during hard rains more water goes into a stream than its banks can hold. Then the water runs over the banks and floods the land on both sides of the stream.

The picture below shows land that is flooded.

Lakes and Oceans

Lakes and oceans are low places in the earth's surface that are filled with water. Oceans are all around the land.

Look at the pictures on page 145 and find the oceans.

The lakes in the picture above are only a few miles long.

The map below shows some very large lakes in the United States. Some of these lakes are several hundred miles long.

The land at the edge of a lake or an ocean is called the shore.

Some shores are sandy. A sandy shore is called a beach.

How is the beach in the picture at the top of the page being used?

Not all shores have sandy beaches. Some shores have high rocks like these. They are called cliffs.

Would this shore be a good place to go swimming? Tell why.

PACIFIC OCEAN
ATLANTIC OCEAN
UNITED STATES
Ohio R.
Mississ.

A Map of North America

The map on page 166 shows the land that is called North America.

The United States is in North America. Find the United States on the map.

What ocean is east of North America?

What ocean is west of North America?

Where are the mountains in North America?

The plains are where you see many long, straight lines close together on the map.

The deserts are where you see many tiny dots close together.

Find the plains and the deserts in different parts of North America.

Find the head of the Ohio river.

Find the mouth of the Ohio river.

Find the head and the mouth of the Mississippi river.

This map shows the largest lakes in the different parts of North America. Find them.

HOW THE LAND IS CHANGED

Men are cutting part of this hill away to build a road. They are changing the surface of the earth.

Have you seen men making changes like this? Tell about the changes.

Men do not change the earth's surface as much as wind and water do.

Wind and water are at work on the land all the time. The next pages tell about some of the changes they make.

The Big Storm

The sky was bright blue, and the sun was shining on the plains. Dust lay deep in the fields.

Little clouds of dust rose around the feet of two boys who were walking along a fence by a big wheat field.

Soon the boys climbed the fence and walked toward a low hill. They had come to hunt for arrow-heads which the Indians had left there long, long ago.

After a while Frank found an arrow-head. The boys were so busy hunting they did not see that the sky was getting darker and darker.

All at once Frank cried, "Look over there! What's happening?"

The sun was out of sight. A thick gray cloud was rolling east toward Indian Hill.

"It's a dust storm!" cried Jack. "And we had better start for home. It's coming fast."

The boys jumped up. But the gray cloud was suddenly all about them.

"Quick! Put your handkerchief over your mouth and nose," called Jack.

The boys tied their handkerchiefs over their faces and dropped down by the trunk of a tree.

They knew they might lose their way if they tried to go home now.

The dust went through their clothes and stuck to their skins. They shut their eyes tight, but the dust got in anyway. It made their eyes hurt, and dusty tears ran down their faces.

Suddenly Frank thought about the fence that was only a few steps to the right of the tree.

"Jack," he called. "If we can get to the fence, we can walk along it all the way to the road."

The boys went toward the fence until they ran into it. They climbed over and walked slowly along the fence.

At last they came to the highway, where the fence turned.

The boys turned, too, and walked along, feeling for the gate to Frank's yard. Soon they came to the gate, and Frank opened it.

"Now," he said, "it's only a short way to our front door."

Hand in hand the boys made their way through the thick dust. They still could not see anything around them.

The boys walked and walked, but they could not find the house. Frank was frightened.

"We should have reached the house before this," he thought. "We must be going in circles."

All at once he hit his toe against something and fell. His hands touched wood. Of course! This must be the back steps.

"We're home, Jack!" he shouted.

Then the door opened, and light streamed out. The two boys tumbled into the kitchen. The first thing Frank saw was his mother's happy face.

"I'm so glad you are safe," she said.

"You don't know how glad we are," said Jack.

But Frank didn't say anything. He was already washing the dust off his face and hands.

Wind Moves Soil About

This city was many miles away from Frank's home. But the wind carried some of the soil from his father's farm high into the air, through the city streets, and into the buildings.

When the wind blows hard, it often picks up dry dust and soil and carries it to some other place.

When the wind stops blowing hard, much of the soil will fall to the ground.

Some soil is dropped in places where plants can grow in it again. But the fields where it comes from are sometimes left with hard, rocky soil that nothing can grow in.

The top picture shows how one farm looked before a dust storm came. Some of the fields had no plants in them. The soil was loose and dry. In other fields new corn and wheat and oats were growing.

A hard wind began to blow, and it picked up the dry, loose soil.

When the wind stopped blowing and the dust storm was over, the fields of growing plants looked like the picture below.

How did the wind change the surface of the land on this farm?

Building a Dam

Tom and Nancy were spending several weeks with Uncle Dick on his big farm.

One day Uncle Dick gave the children some baby ducks for pets.

How tiny and yellow they were!

"See their funny feet!" cried Tom. "They look like paddles."

"Yes," laughed Uncle Dick. "Ducks have webbed feet. They are swimmers."

Nancy and Tom wanted to see the ducks swim.

"Let's take them down to the brook that runs through the meadow," said Tom. "Then we can watch them swim."

But Uncle Dick told him that the brook ran into a river a short way from the meadow.

"The river goes on and on," he said. "The little ducks would swim too far from home. So we never let them go to the brook.

"But I know what we can do. We can make a small pond for them. Then you can watch them swim."

"Oh, that will be fun," said the children.

"Come along with me," said Uncle Dick. "We'll go down to the brook right now and build a dam to make the pond."

The children waded barefooted in the water.

"It is fun to wade in the water," said Nancy.

"I can feel it push on my legs," said Tom.

"Running water is very strong," said Uncle Dick. "It can carry things along with it. Throw a stick into the water and see what happens."

In went the stick, and the water carried it along down the stream.

Uncle Dick pointed to a low place near the brook.

"This will be a good place to make the pond," he said. "We will build the dam here."

"The running water pushes so hard that we must make the dam high and thick," said Tom. "If we don't, the water will push the dam down."

"Yes, you must make a strong dam," said Uncle Dick. "Do you need me to help you, or can you make it by yourselves?"

"Let Nancy and me try it," said Tom. "I think I know how to make a dam."

After Uncle Dick went away, the two children began to work on the dam.

"Let's use sand to make the dam," said Nancy.

"No, sand won't do," Tom answered. "The water would soon wash it away. I'll show you how the water washes sand away."

Tom made a pile of sand on the bottom of the stream. The water ran over the pile and carried it away. In a little while the sand was gone.

"I see that we can't use sand!" laughed Nancy.

"Let's use some of the black earth from the bank," said Tom.

But as fast as they put the black soil in the stream, the water carried it away.

Then Uncle Dick came along and saw what was happening.

"Use another kind of soil," he said.

"Get some clay. It is sticky, and water cannot wash it away easily."

"Put some stones and branches in the stream and put the clay in around them. I'll get something to put on top of the clay."

He showed the children where to find the clay. They carried some of it to the stream and built another dam with clay, rocks, and branches.

Uncle Dick got a spade and began to dig up some grass in the meadow. The roots of the grass grew down into the ground, and so three or four inches of soil came up with the grass. He carried these pieces of grassy soil to the dam.

"We'll put this sod over the clay," he said.

This time the roots of the grass kept the water from washing the dam away.

The dam held the water back and made it overflow into the low ground. It filled up the low place and came almost to the top of the sod. Then Uncle Dick cut a little opening in the top of the sod to keep the pond from getting any larger.

It was just the right size for the ducks to swim in!

Experiments with Moving Water

Experiment 1. Does moving water push?

Hold your hand under a water faucet while the water comes out fast. Does the water push your hand away?

Turn the water on slowly. Then turn it on fast. Does the water push harder when it is running slowly or when it is running fast?

Experiment 2. Can moving water carry soil?

Make a hill of dry soil and pour water over the top of the hill. The water runs down the hill in little streams, taking soil with it.

Where does the soil go?

Does the water make little ditches in the hill?

Pour more water on the hill and see if the ditches get bigger.

Water Carries Soil Away

The picture above shows the side of a hill as it once looked.

Year after year hard rains fell on this hillside, and the water ran down the hill very fast.

The picture below shows how the rains have changed the hillside.

Tell what changes you see in the picture.

How could hard rains make these changes?

This picture shows a corn-field on a hill.

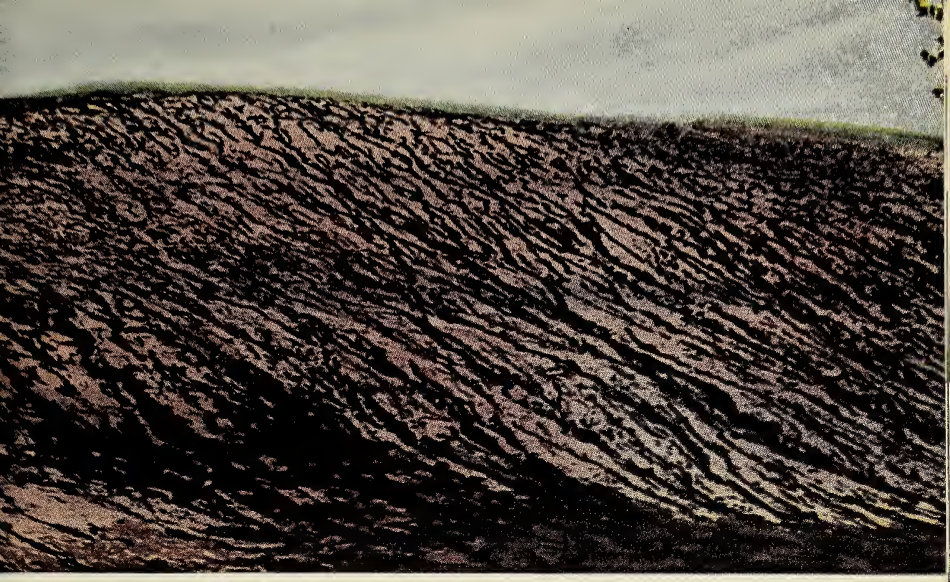
For many years grass covered the hill. The roots of the grass plants grew into the soil and made tough sod.

When heavy rains fell and water rushed down the hill, the sod was not washed away. The grass roots held the soil in place.

Then the farmer plowed up the grass and planted a field of corn.

After the corn was gathered in the fall, the farmer plowed up the roots.

"Next spring I will plant oats in this field," he said.



After the oats were planted in the spring, it rained very hard. Down the hill rushed the water very fast.

The young oat plants were so small that their roots could not hold the soil in place.

The water washed away the black soil. It washed away the young plants.

When the rains were over, the field looked like the picture above.

All the good black soil was gone. Only the hard clay and rocks that were under the black soil were left.

The man did not plant his field again, because he knew that corn and oats could not grow well in such poor soil.

Water Drops Soil

Put some water into a glass. Put a little soil into the water and stir it very fast.

What happens to the soil?

Now stop stirring and wait for the water to stop moving.

What happens to the soil?

When a stream of water is going fast, it can push rocks along with it and carry soil.

But when it goes slowly, it cannot carry so much soil and rock. Then they drop to the bottom of the stream.

The water in the picture on the left-hand page is running very fast. The picture shows where the rushing water has cut through the river bank.

Hard rains have emptied more water into the river than its banks can hold. So the river has flooded. It has flowed over the banks and washed away trees and soil.

As the water flowed over the banks of the river and spread out through fields and towns, it dropped the soil it was carrying.

The picture below shows a big pile of soil that was left in a street after the flood.

Look at the land in the river above. Land with water all around it is called an island.

New land is made around the edges of these islands every year. It is made from soil that the water carries down the river and drops there.

Rivers run very fast as they flow down from high parts of the land. The water washes soil away and carries it along. As the water comes to flat land, it flows more slowly. So it drops some of the soil and builds up new land.

The picture shows the mouth of the Mississippi River.

Every spring there are big floods along this river, and much soil is washed off the farms.

The river carries this soil down toward the ocean.

Some of the soil is dropped on the way. But some soil is carried all the way to the ocean and is dropped at the mouth of the river.

So much soil has been dropped at the mouth of this river that it has made large islands. Now, instead of one large mouth, the river seems to have several small ones. Find these mouths in the picture.

The water is always dropping soil at the edges of these islands. So new land is being built around them every year.

Water Breaks Rocks

Have you ever tried to break a rock?

Find some rocks or small pieces of stone. Hit them with a heavy hammer until they break into pieces.

Hit the smaller pieces until they become dust. This dust is soil.

Rocks are hard and not easy to break. But water can break them!

Here is one way that water breaks rocks. Hard rains fell on this rocky hill, and water rushed down the sides of the hill.

It washed away earth from around big rocks and let them roll down the hillside. Some of them broke. Some rolled for a long way.

When rocks roll, their sides wear off as they rub against other rocks. The tiny pieces that wear off become soil.

Streams of water slowly wear away big rocks and make them smaller.

Here is a picture of a stream that is almost dry. But every spring, when hard rains come, the stream is much larger and flows very fast.

Then the water covers the rocks. As it rushes along, it pushes them and rolls them along, too. They rub against each other, and tiny pieces wear off of them.

The rocks become smaller and very smooth. Some of them are so small that they are only pebbles. Many of these small, smooth rocks and pebbles mixed together are called gravel.

The next time you see gravel along the bank of a stream or a pond, pick up some of it and look at it closely. Notice what size the rocks are. See if the rocks and pebbles are smooth. Why do you think they might be smooth?

It takes many, many years for the big rocks to become small rocks and for the small rocks to become pebbles.

The tiny pieces of rock that wear off of pebbles and larger gravel become grains of sand. As sand grains wear away and get smaller and smaller, they become dust.

Look at some sand with a magnifying glass and see how smooth the sand grains are.

What has made them smooth?

How are the pieces of stone that you broke different from gravel?

Why are they different?

A Way to Save Soil

Find the pictures in your book which show that wind and water tear down the land in some places.

Find the pictures that show how wind and water build up land in other places.

The pile of soil in the picture on page 183 is made of the soil that once covered good farms. After the flood washed the top soil away, there was only gravel or hard clay left.

Plants do not grow well in rocky soil. So farmers must do something to save their soil.

Many farmers keep grass growing in the fields they are not using for other plants.

When plants are growing in the ground, their roots help keep the soil from being washed away by water or blown away by wind.

Even when the corn and hay and wheat have been cut in the fall, the roots of the plants are still in the ground.

Many farmers do not plow up these roots until spring. They know that the roots help save their soil during the winter.

Look at the pictures on pages 173, 180, and 181, and tell how the farmers might have saved the good soil in their fields.

Questions to Answer

1. Which is larger, a lake or an ocean?

2. What is a shore?

3. What is a beach?

4. What is the head of a river? What is its mouth? What are its banks?

5. Find North America on a globe. Find the United States. Find the Mississippi River. Find the place where you live.

6. What two things are always at work tearing down the earth's surface in some places and building it up in others?

7. What changes are made in the earth's surface by a flood? What changes are made by a dust storm? What changes are made by people?

8. How does building a dam across a stream change the land around it?

9. If you wanted to make a dam, what would you use to build it? Why?

10. Tell one way in which farmers can keep the good soil from being blown off their fields by the wind or washed away by rains.

Things to Find Out

In your book you have seen pictures of some of the places on the earth's surface. And you have read about some of the changes that are being made all the time.

You can find out many things about these places and the changes in them by watching the land and water where you live.

1. Which of the different kinds of places you have read about are near your home?

2. Find out what kinds of soil are near your home. Look for sandy soil, clay, black earth, and rocky soil.

3. Find out what kinds of plants grow best in the kinds of soil that are near your home.

4. What river runs near where you live?

Find out where the head and the mouth of the river are.

What other streams does the water flow into before it gets to the ocean?

Find out what ocean it empties into.

5. Watch the water flowing in the river to find out which way is downhill.

6. Find out if the river near you is flowing fast and washing away soil, or is flowing slowly and dropping soil. What new land has it made?

7. Find out if there are gravel and sand along the banks of a river or a lake near your home.

8. How could you find out how far a bottle might travel in a river?

9. Find out what changes men are making in the land about you.

10. Have there been floods or dust storms near your home? Find out what people are doing to keep their fields and homes from being carried away by wind and water.

Part 4 HOW IS WORK MADE EASY?

The people in the picture are raking hay and loading it on the wagon. They are moving it from the field.

The horses are moving the rake. The rake catches up the hay and drops it in piles. From these piles on the ground the men lift the hay to the wagon with long forks.

The forks that the men use are helpers. So are the wagon and the rake. They make it easier for the men and the horses to move the hay.

The story on page 196 tells how a circus is moved and what helpers the circus people use to make work easy.

You use things that help you almost every day. When you move anything, you are doing work. And when you move things, you often use some kind of helper.

As you read about making work easy, find out what helpers you use.

How the Circus Came In

Pulling In the Wagons

Very early one morning Billy and Helen sat in a car with Uncle John, by a field outside the city.

Other people were coming, too. Everybody was watching for something to happen.

All at once a shout went up. The children looked up the road and saw some wagons being pulled along by great, slow-moving animals.

"Why, they're elephants!" the children shouted. "The circus is coming!"

One of the men called to the first elephant, "Over here, Tony." The big animal pulled the wagon to the edge of the field. The other elephants followed him with their wagons.

By this time some men were marking off the field to put up the tents. They marked a place for each one of the many different tents.

Horses pulled a big wagon into the field. All at once it stopped. The horses pulled, but the wagon stood still. It was stuck in the soft ground.

"Bring Tony," shouted the driver. And across the field with slow, heavy steps came Tony with his keeper.

Tony put his head against the wagon and pushed. The circus men pushed, too. Out came the big wagon. Tony walked slowly, pushing it ahead.

He pushed the wagon to the place where it was wanted. Then he pushed another wagon and another.

"Who wants to work for a ticket? Who wants to work for a ticket?" shouted one of the circus men.

Boys ran toward him from all directions. They shouted, "I do! I do! I do!"

The man wanted the biggest, strongest boys, because he was going to give them hard work to do. For their work he would give them each a ticket to the circus.

He took the boys to a wagon filled with stakes. Some of the boys piled the stakes on wheelbarrows and pushed them across the field. Others carried the stakes in their arms.

They took the stakes to all parts of the field and placed them where the tents would be. The stakes were to be driven into the ground.

When the tents were put up, ropes from the tents would be tied to them. They would help hold the tents in place.

Driving the Stakes

Five men drove each stake into the ground with long-handled hammers.

They stood in a circle around the stake they were driving. One after the other, they hit it with their hammers.

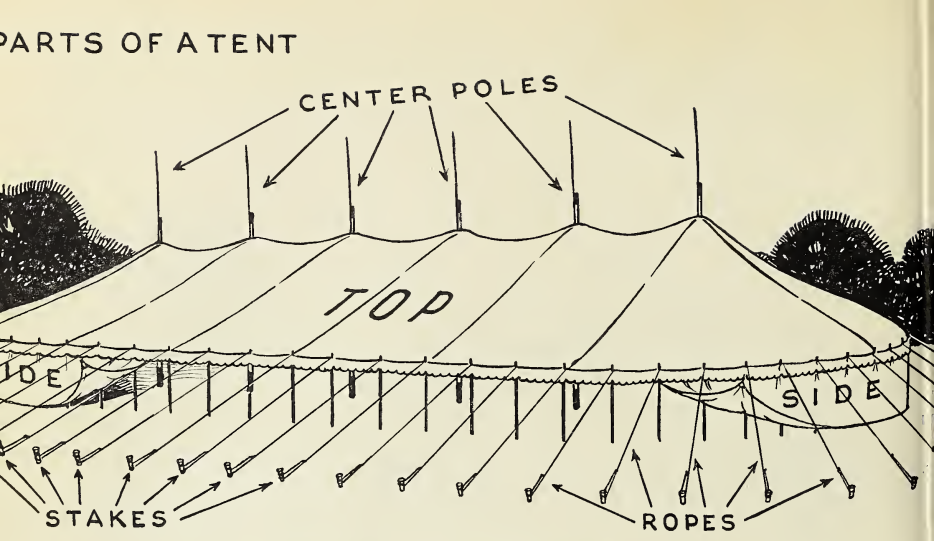
Bang! Bang! Bang! Bang! Bang!

Each time a hammer came down, the stake went deeper into the ground.

Bang! Bang! Bang! Bang! Bang!

The men hit so fast, one after the other, around and around the circle, that the children could hardly see their hammers hit the stake.

When the stake stood only about two feet above the ground, the men walked on to the next stake and drove it into place.



Setting Up the Poles

Each tent had several different parts.

It had a canvas top and canvas sides.

It had tall poles in the center to hold the top up, and many shorter poles on each side.

It had ropes that were tied to the stakes to pull the canvas straight and smooth.

When one of the tents was put up, it looked like the picture above.

Billy and Helen watched the men put up the largest tent.

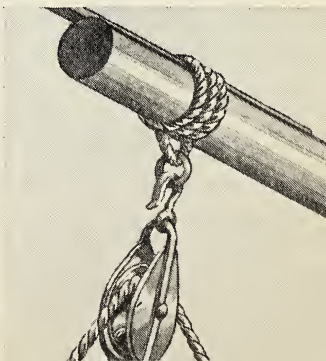
The men began with the center poles. They lifted the poles down from a truck and laid them on the ground.

They laid six of the longest poles in a long line where the tent was to be put up.

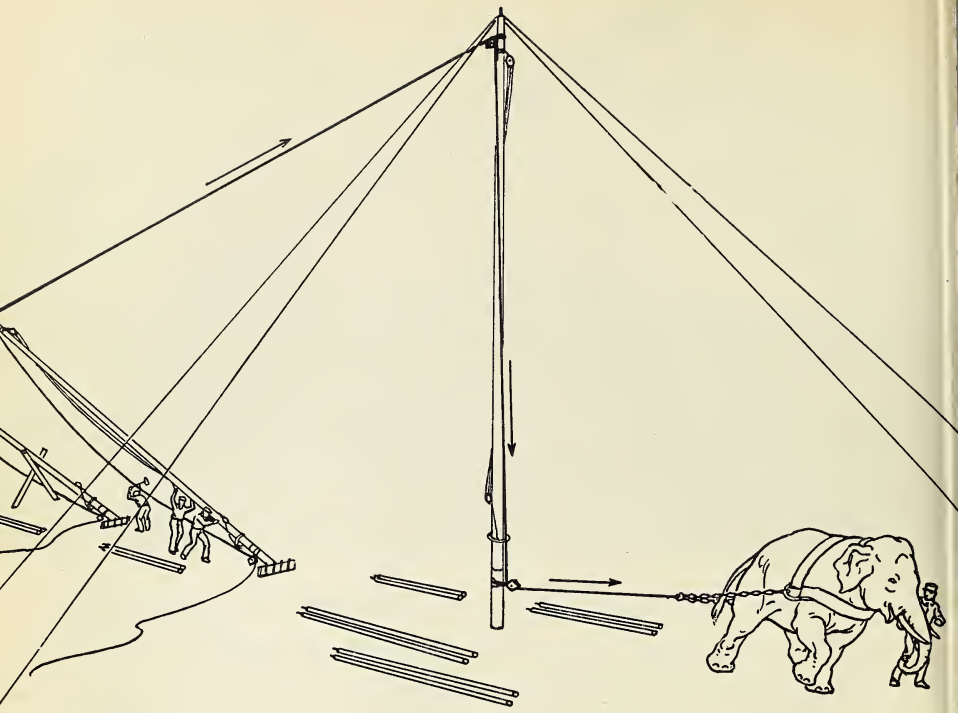
Then the men began to set the first pole up. The pole was very heavy, and it took a great many men to set it up straight.

While the men were setting up the pole, Uncle John showed the children a wheel fastened to the top of it.

"That is a pulley," he said. "Pulleys are used to lift things. The men will use that pulley when they set up the other center poles. Watch and see how they do it."



The first pole was up, and the men were ready to set up the second pole.

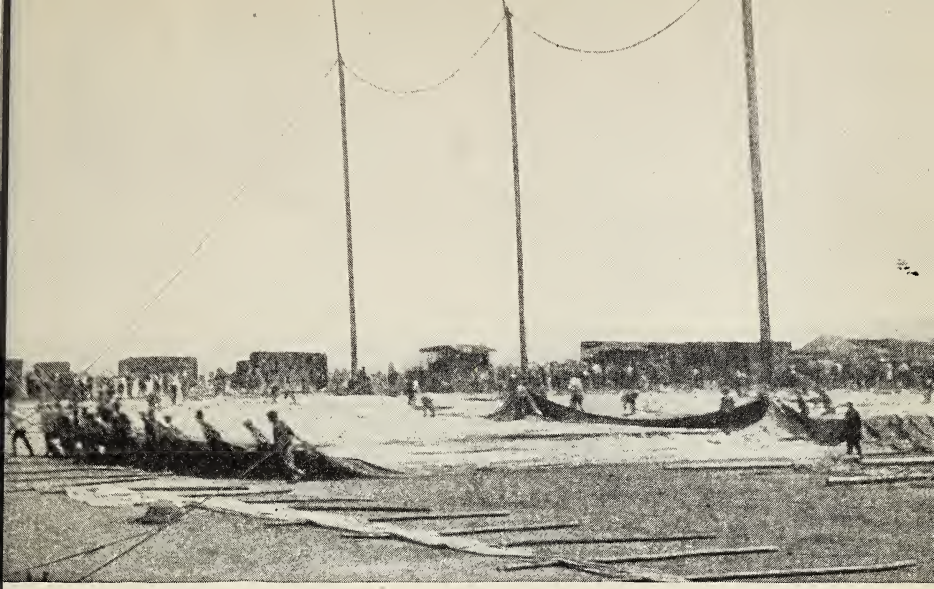


The men did not have to lift the second pole themselves, as they had lifted the first one.

A long rope went up the first pole, through the pulley on top, and down again to the ground. One of the men tied this rope to the top of the second pole as it lay on the ground.

Then Tony's keeper hooked the loose end of the rope to Tony's harness. Tony pulled on the rope, and the rope pulled the second pole up straight.

One after the other, the big poles were set up with ropes and pulleys.



Raising the Top

While the poles were being set up, some of the men carried heavy rolls of canvas and dropped them near the poles. Each roll was a big piece of the tent. It had to be spread out and laced to the other pieces.

Many men worked together to spread out the pieces of canvas. They pushed and pulled and straightened each piece.

Soon all the pieces were spread out flat around the poles.

Then the circus men laced the pieces of canvas together. At last the top of the tent was in one big piece.

Around the bottom of every pole was a big iron ring. The rings were loose, so that they could slide up and down the poles.

The men laced the top of the tent to the iron rings. When they had finished lacing it, the big top looked like the picture above.

"How will they ever get that big tent to the top of the poles?" asked Helen.

"Will some of the men climb the poles and pull it up?"

"Oh, no!" cried Billy. "I see how they are going to pull it up!"

This is what Billy saw.

There was a pulley on every ring, and to each pulley was tied a long rope.

The rope went up the pole and through another pulley on top of the pole.

Then it came down again and went through the pulley on the iron ring.

The rope went up and down the pole several times between these two pulleys.

At last it went through another pulley at the very bottom of the pole. It ran along on the ground and came out at the edge of the canvas.

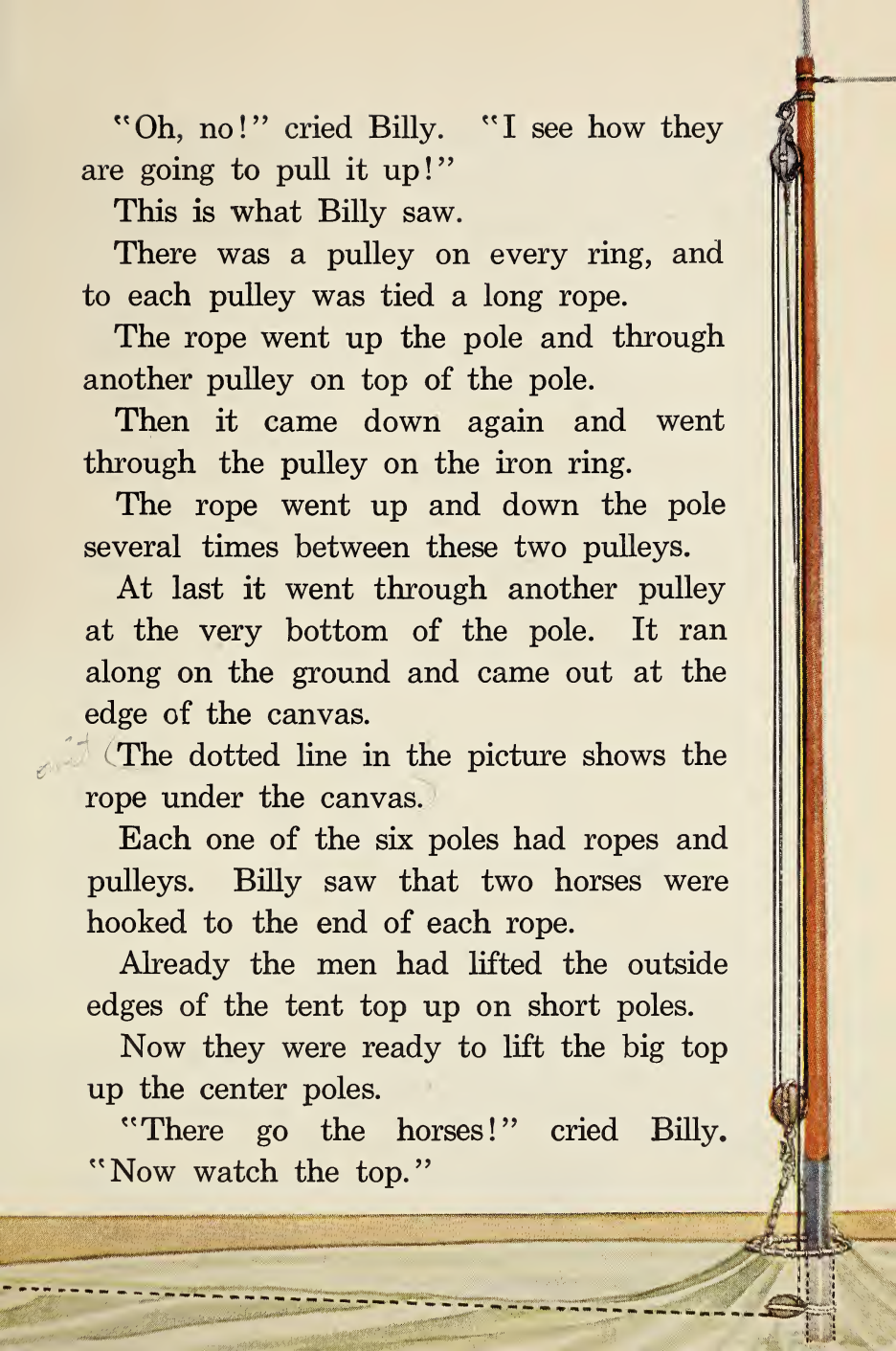
The dotted line in the picture shows the rope under the canvas.

Each one of the six poles had ropes and pulleys. Billy saw that two horses were hooked to the end of each rope.

Already the men had lifted the outside edges of the tent top up on short poles.

Now they were ready to lift the big top up the center poles.

"There go the horses!" cried Billy. "Now watch the top."



Slowly the horses walked away, pulling the rope. Slowly the tent top was pulled up the pole.

"That's funny," said Helen. "The horses pull one way, but the top goes another way."

"That is because of the pulleys," said Uncle John. "The rope goes up and down between the pulleys. At last it comes down the pole and goes to the horses."

"When the horses pull, they pull the rope down the pole."

Billy said, "So they pull the rope down to pull the tent up."

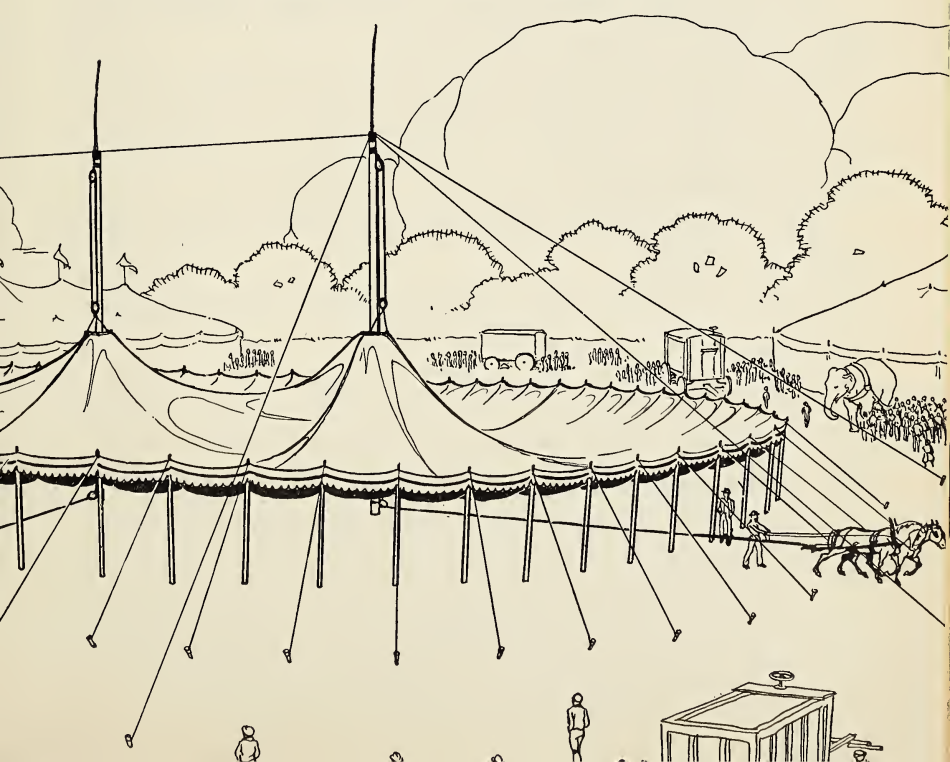
"So that is why the men don't have to climb the poles!" said Helen.

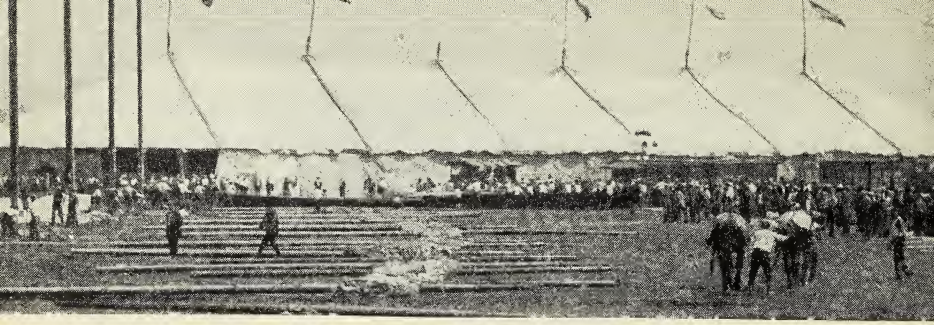
The horses pulled the canvas above the heads of the men. At each of the other five poles other horses and their drivers did the same thing. Then the drivers stopped them.

The whole top was now high enough for the men to work under it.

Next they put up small poles under the tent.

When these poles were up, the horses pulled the tent up higher. This time they pulled it all the way up to the top of the center poles.





Quickly men fastened ropes from the canvas top to the stakes along the sides. They pulled and pulled on the ropes to get them tight.

These ropes pulled the canvas tight and held the tent in place.

At last the big tent was up!

All over the field more tents were going up. They were all sizes and shapes.

There was a big tent for the horses and a tent for the other animals. There was a cook tent and an eating tent.

There were little tents for peanut stands and pop-corn stands.

A city of tents was growing while the children watched!

In the cook tent all the cooks were busy. They were building fires in the big black stoves. And they were peeling potatoes and cutting great pieces of meat. My, what good smells were coming from that cook tent!

"M-m-m!" said Billy. "Smelling food makes me hungry. Let's go home and eat."

"All right," said Helen. "We can eat and then watch the parade."

As they climbed into the car again, they looked back over the busy field.

A few hours ago it had been an empty field with thick, deep grass. Now it was a busy city filled with tents and people.

Boys were running here and there with water for the animals.

Men were carrying things into the tents and getting their peanut stands and pop-corn stands ready.

The animal wagons were being put in line for the parade.

"My!" said Helen. "It's more fun to watch the circus come in than it is to see the show in the big tent!"

And Billy thought so, too.

USING MUSCLES TO DO WORK

When the circus comes in, all the parts of the big tents have to be moved to the circus field and put together.

The big tent pole in the picture was moved to the circus grounds on a wagon pulled by horses. The horses moved the wagon by using their muscles. The men are carrying the pole from the wagon by using their own muscles.

People all over the world lift and carry loads by using muscles. They use their own muscles and animals' muscles, too.

Find out what work you do with muscles by reading the next pages of your book.

Using Our Own Muscles

How are the people in the picture above getting work done?

When you carry in wood for the fire, what do you use to move the wood? When you swing or push someone else in a swing, what makes the swing move?

Whenever any part of your body moves, your muscles are moving it. When you dress yourself or write a letter or breathe or wink an eye, muscles are moving parts of your body and making them work.

When you walk, what do you use to move?

What other work did you do today with your own muscles?

Using Animals' Muscles

Tell what makes the children's wagon move.

By using their pet's muscles to pull the wagon, the children are riding from one place to another. That is easier than if they walked or pulled each other. They are going more quickly, too.

How does the horse make the milkman's work easier?

If this cowboy were on foot, he would have to run to keep up with the cows he is driving. He could not run as fast as they can, and so he would not be able to make them go where he wants them to go.

What is making it easy for him to drive them?

In the cold lands near the North Pole and the South Pole dogs are used to pull heavy sleds loaded with furs and food. These loads are often moved hundreds of miles across the snow.

Several dogs pulling together on one sled can move the sled much faster than a man could move it. And they can pull a much heavier load than he could pull.

If a man tried to pull a plow, his work would be very hard. The plow would be heavy for him to move. It would take him a long, long time to plow a field.

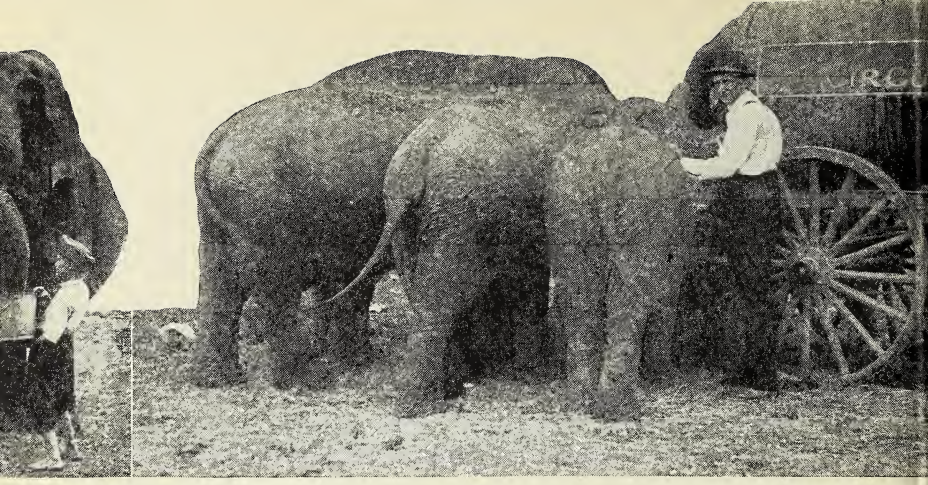
The two horses in the picture pull the plow along easily and quickly. The man walks back of the plow and holds it to keep it from falling over.

But the man does not move the plow ahead. The horses pulling on it make it move.

The man in the picture below is getting his field plowed even faster than the man who is plowing with two horses.

He is using a bigger plow that will plow two rows at a time. He is not working as hard himself, because he is riding instead of walking.

Why can he get more work done than the man with two horses?



GETTING HELP FOR MUSCLES

The boy in the picture has used his muscles to carry water to the elephant.

In the second picture, too, muscles were used for carrying water to the elephants. But here it was carried in a big tank on a wagon. Horses pulled the wagon.

The horses' muscles had four helpers. They are helpers that you often use, too.

Find out what these helpers are by reading pages 217 to 229. And find out what other helpers you use.

Wheels Make Work Easy

How is the girl using her muscles in the first picture?

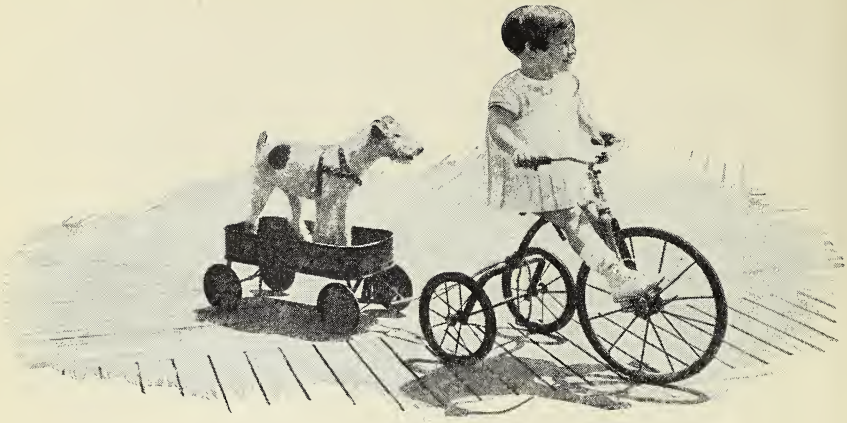
Do you think it would be easy for her to carry the baby a long way? Why?

The second picture shows her moving the baby in another way.

The wheels of the buggy are helping her. They roll along the ground easily and make it easy for her to move the buggy.

What work is she doing with her muscles in the second picture?

Which is easier, pushing the baby on wheels or carrying it?



The muscles in the legs of this little girl are moving the girl, her tricycle, the wagon she is pulling, and the dog.

What is helping her?

When you go roller-skating, you have helpers. The wheels in your skates help you move along much faster than if you walked.

Is riding a bicycle an easier and quicker way of getting somewhere than walking? Why?

The men loading wheat would work harder and more slowly if they had to carry it far.

They load it on the wagon, and the horses pull it. The wagon and the wheat are very heavy. But the horses pull their load easily because the wagon is on wheels.

How are loads being moved easily in the other picture?

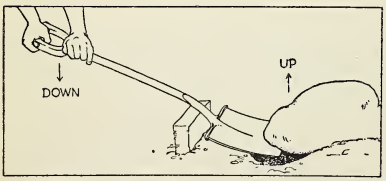
Look at the pictures on pages 212 and 215 and tell what is making it easier for the animals to pull their loads.

Levers Are Helpers

These children are lifting each other with their seesaw board. The board helps them lift. It is the kind of helper that is called a lever.

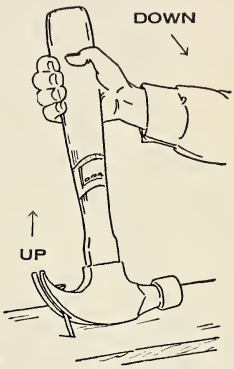
When you push down on one end of a lever, the other end lifts up. You can lift a much heavier load with a lever than you could lift without it.

Levers are used to do many kinds of work. It is very hard to get a big stone out of the ground by using your muscles alone. But you could use a lever and get the stone out easily.



This spade is being used as a lever. When one end is pushed down, the other end lifts the stone.

You use a lever when you pull a nail out of a board.

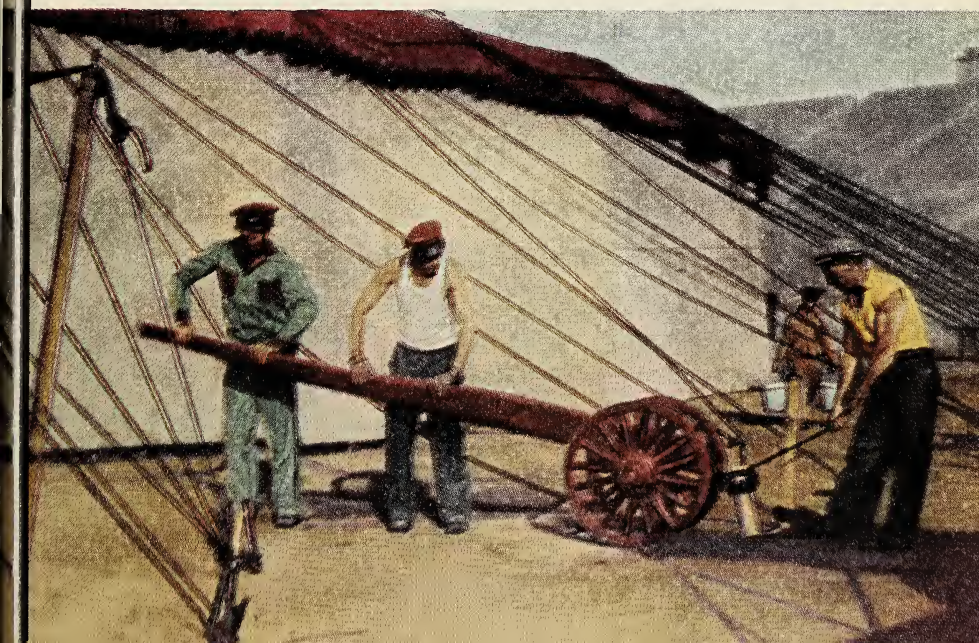


You pull down on the handle of the hammer, and the other end pulls the nail up.

The stakes of a circus tent are driven into the ground so hard that they cannot be pulled up by hand. But they can be pulled up quickly and easily with the machine in the picture below.

The men fasten one end of this machine to the stake they want to pull. Then they push down on the other end, and up comes the stake.

Is this machine a lever? Why?



Using Pulleys to Do Work

People often use pulleys to help them move things from one place to another.

There is a pulley like this at the top of the flag pole. A rope goes up the pole, through the pulley, and down again.

The flag is fastened to the rope. When the boy pulls down on the rope, the flag goes up to the top of the pole.

How could you get a flag to the top of a pole without a pulley?

Experiments with Pulleys

Experiment 1. Find out if a pulley can help pull something to a high place.

Fasten a pulley to a long pole and run a rope through it. Tie the ends of the rope together. Fasten a flag to the rope at the place where the ends are tied.

Set the pole up. Now pull down on the rope. What happens?

You moved the flag to a higher place than you could reach. You pulled down on the rope, and the flag went up.

With a pulley you can pull in one direction and move something in another direction.

In Experiment 1 you used only one pulley. People often use two pulleys to help them lift something very heavy.

The man in the picture above is using two pulleys to help him lift a heavy stone. If he did not use the pulleys, the stone would be too heavy for him to lift.

Each of his pulleys has two wheels.

A two-wheel pulley is shown in this picture.

The rope the man is pulling goes back and forth four times between the two pulleys.

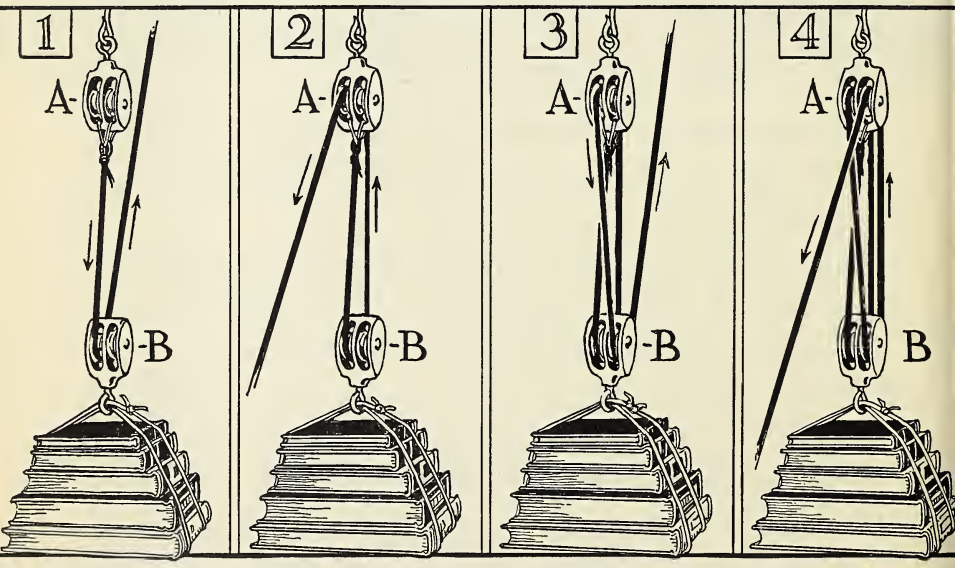
Experiment 2. Find out if you can lift something heavy by using two pulleys.

Ask your teacher to help you fasten a two-wheel pulley above your head. This pulley will be Pulley A.

Then tie another two-wheel pulley to four or five heavy books.

This will be Pulley B.

Next tie a long cord to Pulley A and run it back and forth between the two pulleys like this:

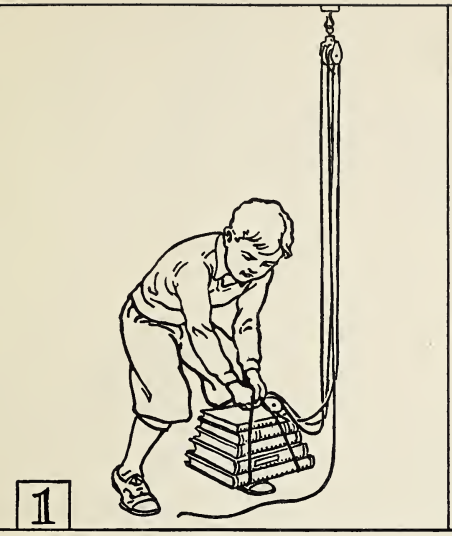


DOWN under the first wheel in Pulley B

UP over the first wheel in Pulley A

DOWN under the second wheel in Pulley B

UP over the second wheel i Pulley A



Now you are ready to find out if the pulleys will help you lift the books.

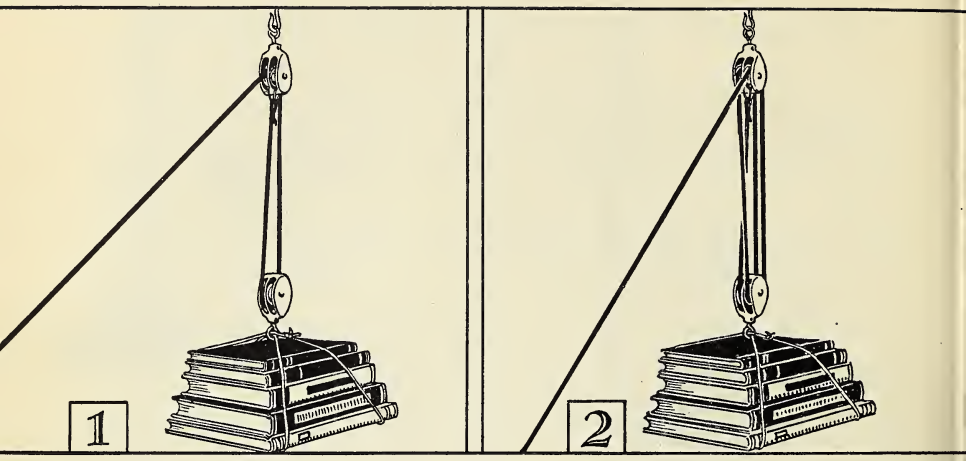
First take hold of the cord around the books, as Picture 1 shows you.

Lift them to find out how heavy they are.

Then lift them by pulling on the cord that goes through the pulleys, as Picture 2 shows.

Which way is easier?

In this experiment the cord goes back and forth between two pulleys four times. Do you think it would be as easy to lift the books if the cord did not go back and forth so many times? You can find out by doing the experiment on the next page.



Experiment 3. Place your cord as Picture 1 shows. Lift the books by pulling on the cord. Is it easy?

Place your cord as in Picture 2, and pull.

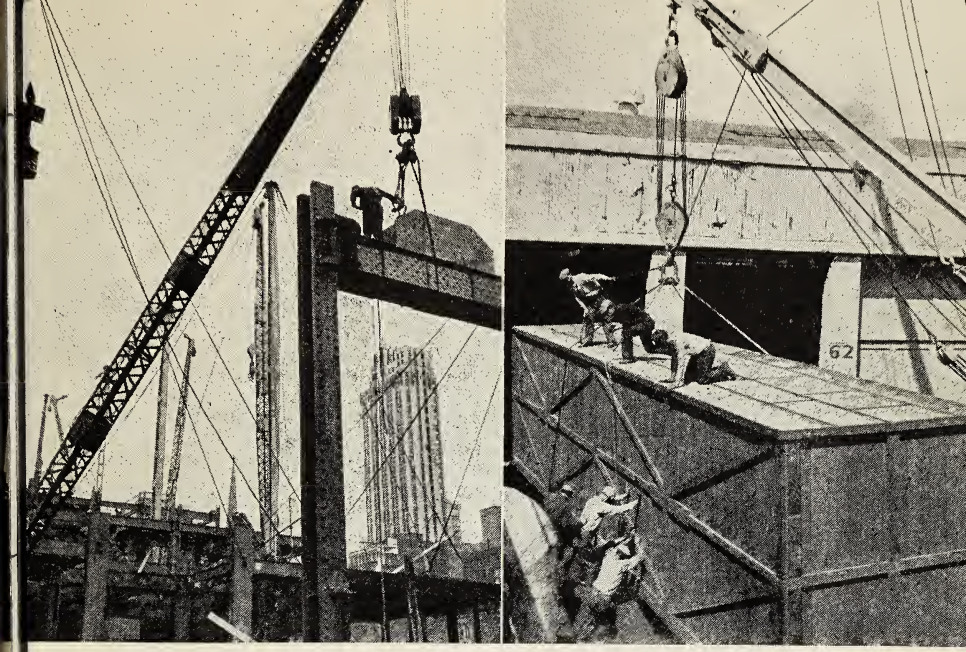
Which time was it easiest to lift the books?

When did you have the cord going back and forth the most times?

The more times that a cord or rope goes back and forth between two pulleys, the easier it is to lift something heavy with them.

In the picture on page 205, find the pulley at the top of the tent pole and the pulley that is fastened to the canvas.

Did using these two pulleys make it easier for the circus men to lift the heavy tent top? How can you tell?

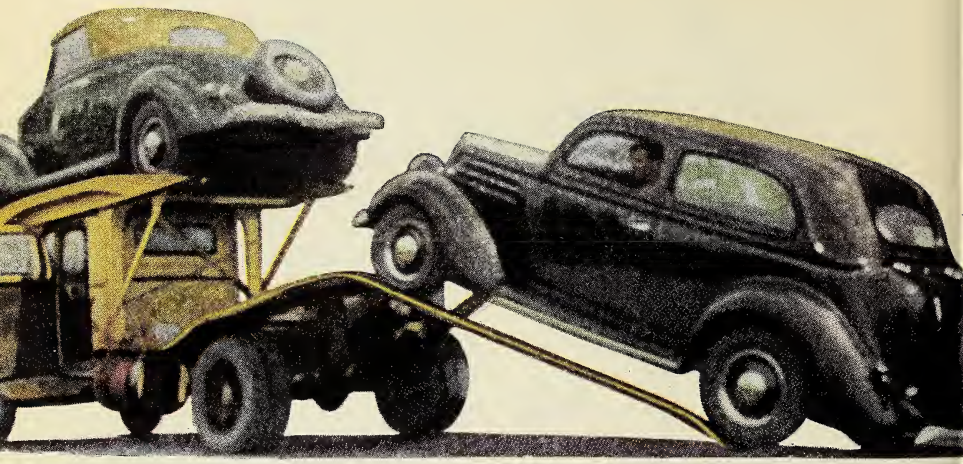


In each of these pictures the men are using pulleys to help them lift something that is very, very heavy.

In the first picture they are putting up a high building and lifting part of it into place.

The big box in the second picture is filled with parts of airplanes. It is being loaded on a big ship to be moved across the ocean.

Are the pulleys making it easier for the men to lift the heavy loads?



An Inclined Plane

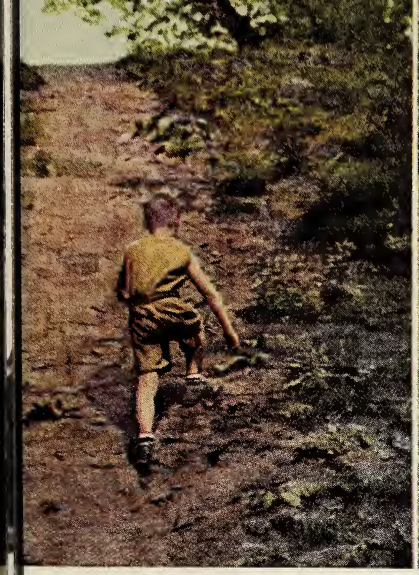
Look at the tracks that slope up from the ground to the back of the truck in this picture.

How are the tracks being used?

Anything that slopes up as these tracks do is called an "inclined plane." "Inclined" means sloping. "Plane" means something with a flat surface, such as a board.

It would be very hard to lift the car up onto the truck. But it is very easy to drive it up the inclined plane.

People often use an inclined plane to move heavy things to a higher place. It is easier to push or roll them up the sloping board than it is to lift them straight up.

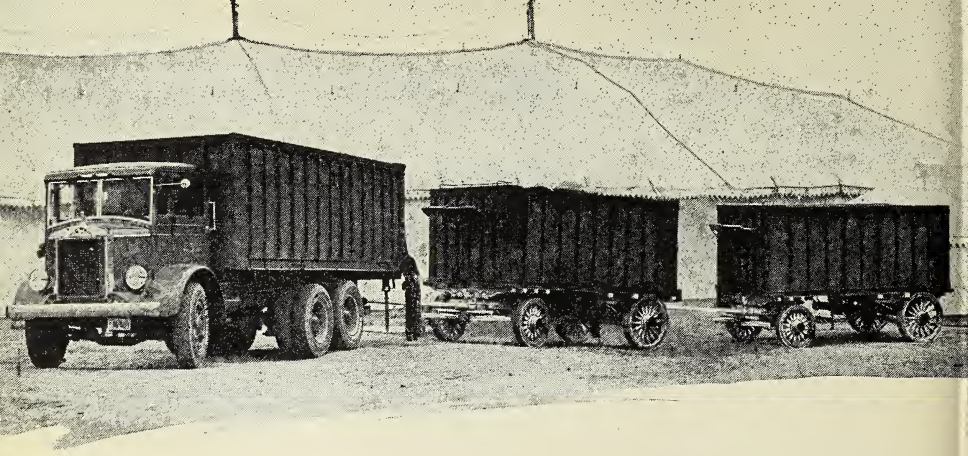


If you wanted to get to the top of the hill in the first picture, you would have to climb up. Your muscles would get very tired pulling your body up this steep hill.

The second picture shows that a sloping path makes it easier for you to walk up a steep hill. This sloping path is an inclined plane.

Tell about an inclined plane that you have seen making work easier. For what kind of work was it used?

Name three other helpers that make it easier for muscles to move heavy things.



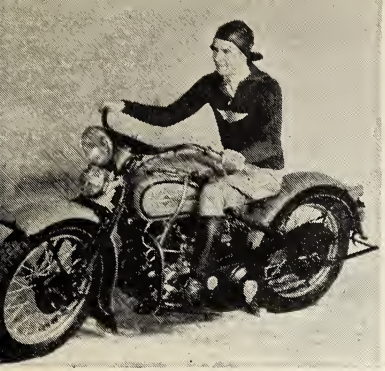
USING ENGINES TO DO WORK

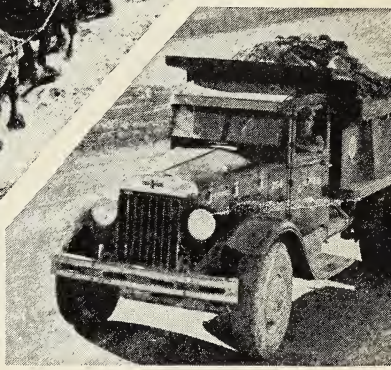
Circus people do not always use horses or elephants to pull their wagons. Sometimes they use trucks like the one in the picture.

There is an engine in the truck that makes it move. As it moves along, it can pull a heavy load.

You see engines pulling loads every day. Did you ride to school this morning in an automobile or street-car? What made the car move?

The next pages tell you about the work that engines do.





Engines Move Heavy Loads

An engine in the motorcycle above makes it move. The engine is doing the work that the boy's muscles are doing on the bicycle.

How many horses are pulling the loaded wagon?

An engine in the truck is doing the same work that the horses are doing. The engine makes the wheels of the truck turn, and so the truck moves.

The engine can pull a heavier load than the horses can pull, and can move the truck faster.

In each of these automobiles is an engine that makes it move.

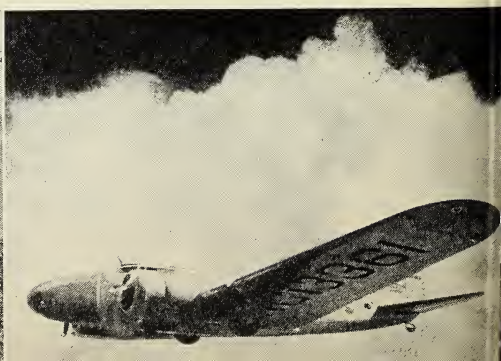
The automobiles are heavy, and people are riding in them. But the engines can move these heavy loads very fast.

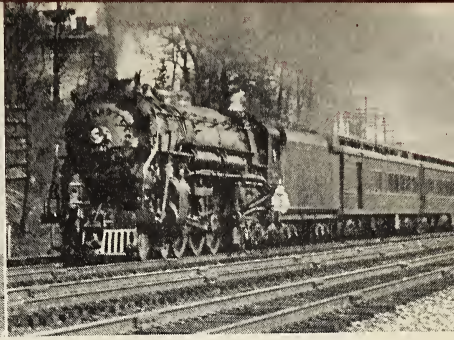
Gasoline is used to make the engine run in most automobiles and trucks. The truck or automobile has a tank that is filled with gasoline.

The gasoline runs into the engine as the car moves along.

What happens if the tank gets empty?

The picture below shows two other machines with engines that are run with gasoline. What work do these machines do?





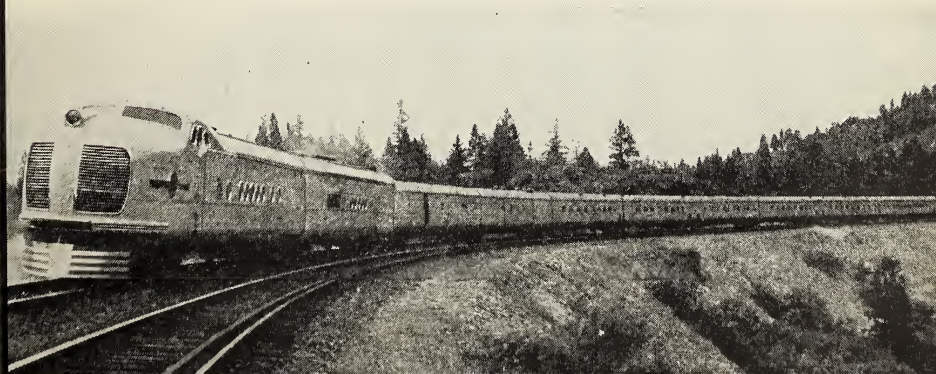
Some engines are run with steam.

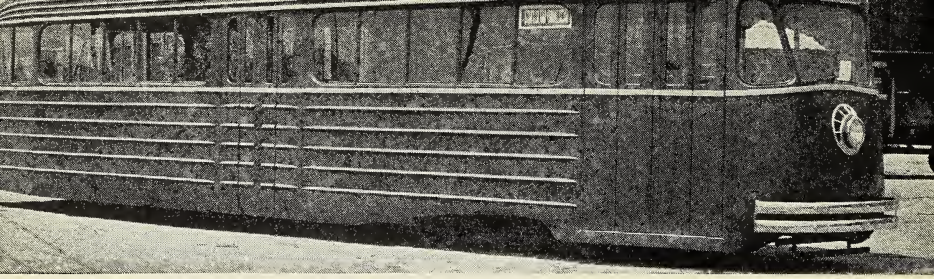
The ship and the train in the picture above are moved with steam engines. Their engines move them along very fast.

The engine of the train in the picture below is run with oil.

Men learned how to use this kind of engine for a train only a few years ago. This new train can move faster and more easily than a train that has a steam engine.

The ship and the trains are very heavy, and they carry many people and heavy loads of goods. Their engines pull loads that are hundreds of times as heavy as the load in the truck on page 231.





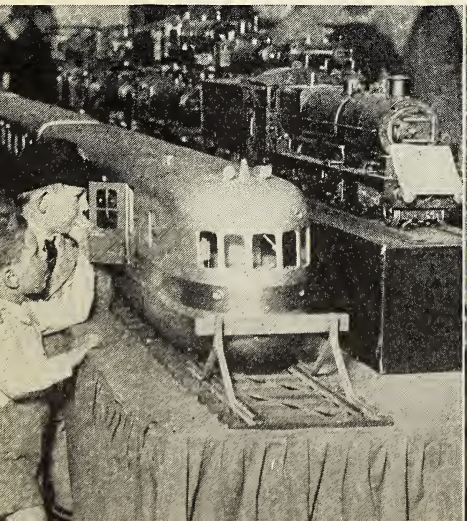
Many engines are run with electricity. They are usually called motors.

Electric motors make the wheels of street-cars turn.

Many trains are run with electric motors, and toy trains and many other toys are, too.

Electric motors run machines that help do work in our homes. The girl in the picture below is using one of these machines.

Name the machine and tell what work the girl is doing with it.



Questions to Answer

1. When your hands or feet move, what parts of your body are doing work?

2. Which of these things can make something move?

a wagon	animal's muscles
an engine	an inclined plane
a rope	people's muscles

3. In what ways do people use animals to do work?

4. Tell one way in which each of these things are used to do work.

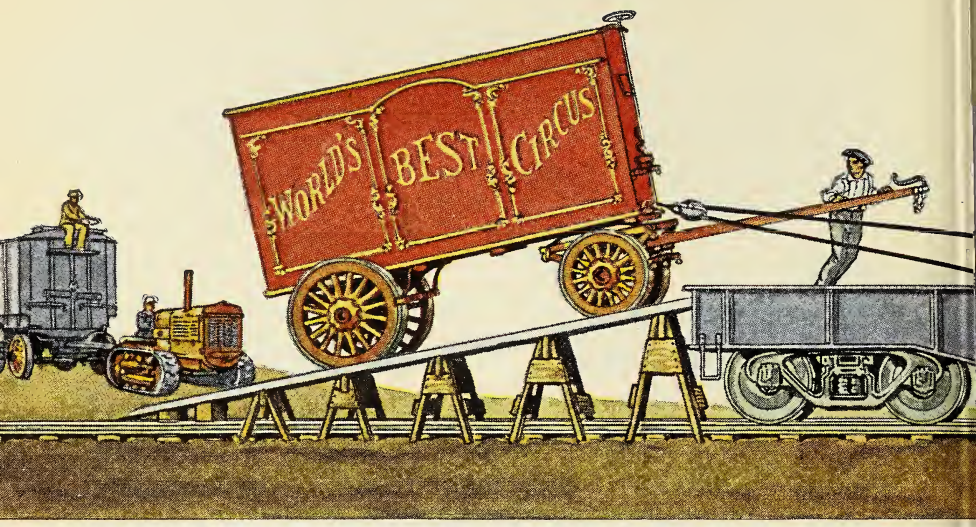
gasoline engine	electric motor
steam engine	horses

5. What is a pulley?

6. Tell how each of these things is used to make work easier.

wheel	lever
pulley	inclined plane

7. For what kinds of work are electric motors used in your home?



How the Circus Is Loaded

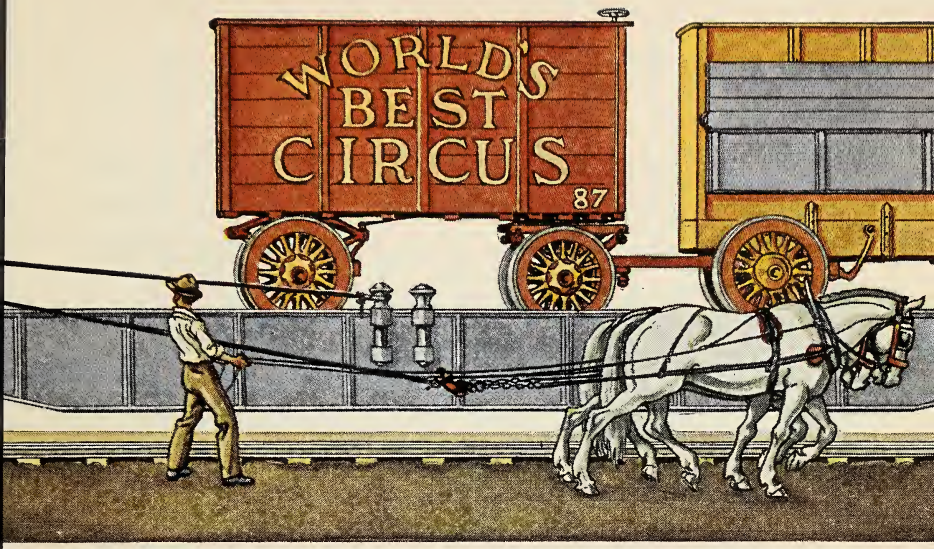
The circus that Billy and Helen saw came into town by train.

The animals and tents and poles and all the other circus things were unloaded from the train and taken to the circus field.

After the circus was over, everything was taken back and loaded on the train again to go to another town.

This picture shows the circus being loaded on the train.

There are little iron bridges between the cars so that it is easy to pull the wagons from one car to the other.



How many of the different kinds of helpers that you have read about can you find in the picture?

What are the men doing?

What are the horses doing?

Name three helpers that are making it easier for the horses to pull the circus wagon onto the car. How is each helper being used?

How is an engine being used in the picture?

What makes the engine go?

What is making it easier for the engine to pull its load?

Using the Index

Open your book to page 240. The words you see on that page have numbers after them. These numbers are the numbers of pages which tell about things in your science book.

Notice that all the words beginning with "A" come first.

All words beginning with "B" come next.

Find the words that begin with "E."
Find the words that begin with "M."
Find the words that begin with "W."

Look for the word "alligator."

Write the numbers of all the pages that tell about alligators.

Look at page 84 and find out what it says about alligators. What can you find out about alligators on page 90? What do pages 118 and 149 tell you about this animal?

Look for the word "beaver." Write the numbers of the pages that tell about beavers. Which of these pages show pictures of beavers? Which page tells how the beaver moves about in water? Which page tells how the beaver builds his home?

Which pages tell about whirligig beetles?

Use your index to find the answers to these questions:

1. What is a bulb?
2. How is a cactus plant protected from being eaten by animals?
3. What is the earth's surface?
4. What is an evergreen tree?
5. What is an island?
6. Find the picture that shows how levers are used.
7. Look for the word "rain" and find out how rain changes the earth's surface.
8. What is gasoline used for?
9. What animals breathe with gills?
10. How are rabbits protected from their enemies?
11. How many maps are in your book?
12. What is a nuthatch?
13. What does "migrate" mean?

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TEACHER'S NOTES

This book is to be used as a textbook so that definite assignments can be made throughout the school year. The teacher should acquaint herself with the underlying purpose of each unit and the suggestions for teaching. Survey the experiments and activities called for in the text and plan for the time and materials required to work them out. (See paragraph below, and notes for pp. 34, 35, 44, 49-50, 62, 144.) Particularly, plan the work so that the experiments on pp. 49-50 will be properly timed.

Remember that the purpose of this book is to arouse the child's interest in his own immediate surroundings and guide him in understanding them. Pages where it is imperative to have local conditions well in mind and adapt discussions to them are listed.

At all times encourage an attitude of respect for scientific procedure. Insist on accuracy in observation and the following of directions; avoid drawing hasty conclusions; experiment to solve a definite problem that is clearly before the class.

The following notes are to be regarded only as supplemental to the teacher's guidebook, *Science for Children*, published by Scott, Foresman and Company, which presents a complete survey of elementary science in the first three grades. This guidebook includes detailed suggestions for reading, for development of science activities, and for handling live specimens and other materials.

Material needed for experiments and activities required by text:

Page 21. Magnifying-glass, flies.

Page 23. Earthworms, magnifying-glass.

Page 27. Earthworm, piece of glass.

Page 28. An aquarium jar, sand and rocks, pond snails, small fish from ponds, water vegetation, water insects, frog's eggs or tadpoles, and any other water animals that will add interest to an aquarium.

Page 32. Crayfish for the aquarium.

Page 47. Earthworm, can of soil, water.

Pages 49-50. Beans, square aquarium tank filled with earth, growing plant, mason jar, piece of paper, rock or stone to place on top of jar, grass seeds, small box of sand, small box of earth, nasturtium seeds.

Page 63. Geranium leaf, microscope.

Page 178. Small mound of dry soil, water.

Page 186. Rocks or pieces of stone, a heavy hammer.

Page 222. A one-wheel pulley, hook, rope, small flag or handkerchief.

Page 224. Two two-wheel pulleys, long rope, four or five heavy books.

Underlying Purpose of Part 1, Where Do Living Things Live: To develop the understandings (1) that animals and plants live in different habitats; (2) that different habitats present different living conditions; (3) that each animal or plant has structures and habits which enable it to carry on life activities under the conditions of its own habitat.

See note for pages 75-77 for important generalization to be made in this unit.

Chapter I. Land Animals. If possible, have live animals brought into the classroom for observation. Tell how the cat is fitted to catch mice and birds, pointing out padded feet, sharp claws, etc. Knowledge of what animals eat is necessary as a background to the understanding that they move in certain ways to get it.

All animals that live on the ground or in trees or other objects attached to the ground, or that alight on the ground from the air are regarded by this chapter as land animals, except those that are equally at home in a water habitat. In the study of this chapter it should be remembered that a chapter on "water-land" animals will follow, and the examples of animals studied at this time should not be drawn from that type.

Pages 8-12. These pages introduce in a story setting the important concepts of the chapter and furnish background for the idea that habitat conditions are often difficult to meet.

Pages 13-15. Stress that animals must have food, water, and air in order to live. These necessities must be clearly in mind before any of the material in this unit will have meaning.

Compare the feet of rabbits and dogs with those of squirrels and cats. Have the children compare these with their own hands and feet.

Pages 15-17. Children are conscious of the fact that they breathe and that they have skin on their bodies. But they should be made aware of the importance of these two facts. Observe the body coverings and breathing movements of the animals brought into the classroom as an aid in understanding these particular adaptations.

Page 16. The popular term "horned toad" is used here to avoid confusion. However, some authorities prefer the name "horned lizard," since the animal is really a lizard and not a toad.

Page 21. Place a fly or other flying insect under a magnifying-glass so that the children can closely observe the delicate wing structure. If

the glass is strong enough, they can observe the delicate pads and "claws" on the fly's feet, with which it clings when it walks on ceiling or walls.

Stress that animals that fly have two structures—wings and legs—which help them move, and discuss cases in which the wings are a better means of transportation to the food supply than the legs.

Page 27. In question 4 the point should be made that the stiff hairs on the earthworm cannot take hold of glass as they can in soil.

Chapter II. Water Animals. Take children to a pond to observe the animal life there and to collect specimens for an aquarium. (See the teacher's guidebook, *Science for Children,* for description of proper materials and instructions. See also note for page 44.)

Page 28. The animals shown, from the top of the picture down, are sunfish, fairy shrimp, stickleback fish, crayfish, clam, and water snail.

Pages 29-30. These pages stress the fact that water animals are fitted to move and get their food in their particular water habitat. The fish has muscles which enable it to move. But it cannot move as well on land as in water.

Page 34. Children will probably need help in identifying the oyster's gills. If possible, have some oysters at hand for observation.

Page 35. Almost the only way to give children an accurate idea of scales is to have at hand a fish or a portion of fish skin from which the scales can be stripped for observation.

Chapter III. Water-Land Animals. This term refers to animals that spend a considerable portion of their time in or on water, as well as the true amphibians, of which the frog is the well-known example. The common amphibious insects, such as the dragon-fly and the mosquito, are not shown, because the children have not had the background necessary to understand the growth characteristics which make these insects amphibious.

Page 36. The answers expected in the second paragraph are: muskrat, turtle, frogs, and ducks. (The ducks are mallards and wood-ducks.)

Pages 37-39. The story makes the child conscious of the close resemblance of this animal group to land animals, but stresses the differences in structure that provide for adaptation to water as well as land.

Page 44. If the field trip suggested above is taken in the spring, frog eggs should be one of the items collected. The eggs will hatch in the aquarium, and children can watch the tadpoles develop over a period of weeks. (It takes several months for the development described on page 44. See *Science for Children.*)

Page 47. If the soil is thoroughly soaked, the earthworm will come to the top. The worm is a land animal and cannot breathe under water. In a hard rain the water drives him to the top of the ground.

Chapter III. Land Plants. Page 48 should acquaint the teacher with the children's knowledge and past experiences concerning the requirements of plant life. The answers to the question in the first paragraph should include identification of trees, flowers, bushes, and grass, the generic term of plants.

Pages 49-50: Experiments. See p. 243 for materials needed. To function properly, the experiments must have time to develop before the pages are read where their use is required. Experiment 1 will be needed on page 54 and will take five to eight days to develop properly. Experiment 2 is used on page 57 and will develop over night. Experiment 3 will be needed on page 59; it will develop in five to eight days. Experiment 4 is used on page 64 and should have at least two weeks.

If the children notice the direction in which the bean roots grow before the reading is reached, use this interest to motivate the reading.

Page 51. This story reviews the growth requirements of plants and the function of leaves, roots, stems, and flowers, from *Science Stories, Book II.* Such a background is necessary to develop the idea that plant structures differ in varying habitats. See notes for pages 54-62.

Page 54. Do not attempt to go into the complicated process of photo-synthesis. The points to be stressed here and on the pages immediately following are: (1) Plants make their own food; (2) to make food they must have water, light, and air; (3) the roots, stems, and leaves of land plants are so constructed that they can secure these necessary elements in their land habitat.

Page 55. The photograph shows a tree in a bank that has caved away and left the roots exposed, as the best method of illustrating the natural structure of the roots and their position in relation to the tree. Any illustration, however, leaves much to be desired. To develop an accurate impression of the extensive root system typical of a tree, actual observation of uprooted trees is essential.

Pages 58-59. Almost any bean plant grown indoors will shoot up on long, spindly stems within a few days after sprouting. Point out the weak, undersized leaves, spindly stems, and sickly color of the plants as they reach toward the source of light.

Page 62: Experiment. These are interesting activities that can be started when the page is read and kept going to advantage as the

reading progresses to the next chapter. Their purpose is to prove the truth of the statements made in the foregoing material. Several sets of these experiments should be started in order to insure success and to note the variations of behavior.

Page 63. On this page the use of the microscope is suggested for the first time. If a microscope is available, it should be used to observe various common subjects, and a consciousness built up of the extremely great change that a microscope produces in the appearance of the subject under observation. For example, a geranium leaf will no longer look like a geranium leaf under the microscope. Only a small part of it will come under the lens, and that part will be so greatly magnified that the pattern of the leaf visible to the naked eye will be lost and a radically different pattern will take its place.

Chapter V. Water Plants. Nearly all the plants included can be grown in the aquarium. (See *Science for Children.*)

Pages 68-71. The questions on page 68 should serve to develop an intelligent interest in the behavior of water plants. The story shows that the structures of water plants have the same functions as those of land plants. The rest of the chapter shows how these structures are modified in plants that live in water.

Page 73. If children are puzzled by discussing the cat-tail as a water plant, point out that it is never found except in the immediate vicinity of water or where water has recently been.

Pages 75-77. The chart and the exercise based on it call for grouping and recording in permanent form the important generalizations to be drawn from the unit. The grouping should be as follows: Living Things: They grow; they have to have food; they have to have air; they have to have water. Animals: They are fitted for moving about; they must find their food. Plants: They use air, water, and light to make food; their roots take in water; they take in air through their leaves; they grow toward light and water.

After the chart is set up so that the children can follow it, the exercise on pages 76-77 should be used to call forth generalizations concerning the various types of animals and plants.

Underlying Purpose of Part 2, How Are Living Things Protected: To develop the understandings (1) that most animals are preyed on by other animals using them for food; (2) that animals are protected in one way or another from their enemies; (3) that plants are protected from adverse biological and climatic conditions.

Chapter I. How Animals Defend Themselves. In this chapter are included the characteristics of structure and behavior that tend to protect the individual animal. Characteristics similar to those pointed out by the text can be observed in almost any wild animal.

Special care has been taken not to present protective structures as being developed to fill a need. The presentation is conducted from the basis that certain animals are equipped with certain structures and are therefore able to protect themselves. For example, the simple fact that a bee has a stinger and so can defend itself is the basis for discussion, rather than the somewhat dubious interpretation that the bee needs to defend itself and therefore has a sting.

Pages 78-82. These pages present the general ideas of the struggle for existence as a background for understanding the protection-affording structures of the various animals.

Page 91. In connection with the last three lines, bring out the similarity of the prairie dog's color to that of his natural background.

Chapter II. How Homes Protect Animals. The subject of animal homes is a familiar one in the earliest literature the child reads. Supplement the study of the picture on page 96 with discussion of early stories, and by suggesting ways in which the children are protected by their own homes.

Page 104. Point out that the larks hide their nests in bunches of grass so cleverly that it is almost impossible to find them. The prairie lark often makes its nest in a tiny hollow in the ground, and uses no concealment except a perfect matching of the ground's color in her nesting materials.

Chapter III. How Animals Take Care of Their Babies. Here again the subject matter is familiar to children. Their past experiences should be utilized in connection with page 112.

The points to be stressed in the chapter are (1) some animals produce an extremely large number of offspring and give them no care; but the number is so large and the young are so independent that some of them survive; (2) some animals produce only a few offspring and give them a large amount of care. These ideas are developed in the text on a gradually rising plane that is climaxed by a discussion of the human baby and the care it receives from its parents.

Page 112. The material on pages 113 to 127 does not include discussion of the protection given to fawns and baby rabbits. They are referred to in the exercise on page 126, and the children should be

able to deduce from the number of these animals that they are given protection. If additional information is desired, it can be found in the many children's stories about fawns and rabbits.

Pages 113-114. The ideas of the chapter are introduced in story setting, an average example being shown to furnish background for the more specific discussion that follows.

Chapter IV. How Plants Are Protected. The important ideas to keep in mind in this chapter are (1) all plants are protected from adverse climatic conditions in some way, so that species survive from year to year; (2) certain plants are protected by thorns and other characteristics of growth.

Pages 138-141. Use to stress the important generalizations.

After the study of this unit is completed, the children should be able to understand the importance of conservation of useful plants and suggest ways in which children can protect plants.

Underlying Purpose of Part 3, the Earth's Surface: (1) To acquaint children with the various land and water forms; (2) to develop the ways in which those forms are constantly changing; (3) to introduce the concept of a map; (4) to develop ability to interpret a simple map.

Pages 142-143. These pages are intended to give a general impression of what the earth really is. The teacher may supplement this information according to the interest of the pupils.

Keep in mind the motivation in the last two lines of page 143, and continually call to the child's mind applications of the text to his own surroundings.

Chapter I. The Land and Water on the Earth. This chapter reviews the study of earth forms started in *Science Stories, Book II,* introduces a few additional forms, and provides a gradual introduction to map reading in meaningful situations.

Pages 144-145. Supplement the text and pictures with study of an actual globe. No detailed study of continents is intended. These pictures merely serve as a background for the introduction of the map concept and show the distribution of land and water.

Pages 146-147. The child's first concepts of a map are (1) that it is a picture of the earth's surface to show contour; (2) that a map shows more of the earth's surface than the eye can possibly see. The ability to interpret pictures taken from the air was developed in Science Stories, Book Two. This ability facilitates the interpretation of simple relief maps.

Pages 152-153. After reviewing land forms help the children locate the area in which they live on the map on page 152. Take field excursions to acquaint the children with land forms in their vicinity. Make contour maps on the sand table to show the land forms presented.

Page 156. This page serves to introduce water forms. Present by observation the idea that in rivers water is always moving.

Pages 157-159. In a story setting are developed the concepts that water flows in streams, that streams are many miles in length, and that they run into other streams or into the ocean.

Page 160. The exercise and map apply the ideas in the preceding story and introduce a new technic in map interpretation.

Distances can be accurately estimated by laying a string along the line of the river and then measuring its length on the scale in the map.

Pages 161-162. Further application of map reading is provided in the introduction of the idea that *water runs down hill* and to make more meaningful the new terms, the *head* of a river, the *mouth* of a river.

Page 164. The teacher should supplement the ideas which are presented on this page by the explanation—oceans surround continents; land surrounds lakes.

Chapter II. How the Land Is Changed. The main concept of the chapter is that land is always being built up and torn down by wind and water. Attention is centered on the more rapid changes that are taking place, since the concept of gradual changes cannot be grasped at this level.

Encourage children to tell about any changes that have been caused in their vicinity by floods or wind, in connection with page 168.

Pages 169-171. In the setting of a dramatic story is presented the concept of wind moving soil and the resultant dust storm that has played havoc in the prairie states in recent years. Stress the effect on people and lands of these storms, as well as the concept that wind can carry soil.

Pages 174-177. This story introduces the ideas that running water has force and washes away soil. Stress the part that plant roots play in holding the soil together and preventing its being washed away.

Page 182: Experiment. Make certain that each child sees what happens as the movement of the water becomes slower. The concept that the water in rivers drops the soil it is carrying as it slows down in the lowland is necessary for an understanding of erosion presented in the geography study of later grades.

Pages 188-189. Try to develop an understanding that such changes as these are very gradual and continue over a period of years.

In the comparison at the bottom of page 189, bring out that the sand grains and the gravel have been worn smooth by the water constantly rubbing them against other rocks; but the pieces of stone broken with the hammer were broken by a series of heavy blows that left them sharp and jagged. Refer to the picture on page 187 and show the similarity of this action to that of breaking stone with a hammer. Look for the two types of erosion in the neighborhood.

Underlying Purpose of Part 4, How Is Work Made Easy: To develop the understandings (1) that to move something is to do work; (2) that work is done by muscles and by engines; (3) that certain tools or machines are aids in doing work.

No attempt is made in the development of this material to explain *why* these devices operate as they do. The aim is entirely to make the children consciously think about the things they are familiar with and see every day, and to notice the ways in which we supplement our muscular power by using these various devices.

Page 196. The story that starts on this page furnishes background for all the important ideas of the unit. As the story is read, do not let it become over-burdened with the detailed development that rightfully belongs to later pages.

Page 201. It is desirable to show an actual pulley in introducing the term.

Pages 204-207. The experiments on pages 223-226 will set up a situation that clarifies the concepts. The main point to be stressed here is change of direction—that the big tent was pulled to the tops of the high poles by horses that walked on the ground and pulled a rope in another direction. The diagram on page 202 presents this idea graphically.

The diagram on pages 204-205 introduces a new skill in the interpretation of a dotted line as showing a concealed object. Make sure that the children interpret it correctly.

Chapter I. Using Muscles to Do Work. The child's past experience in using his muscles to do work is translated into the first basic principle of the unit, which is that work can be done by muscle power.

Page 211. Stress the concept expressed in lines 6-10.

Pages 214-215. Bring out that the addition of two more horses adds to the speed and ease of accomplishing the work.

Chapter II. Getting Help for Muscles. This chapter reviews the use of the wheel and the lever in making work easier from *Science Stories, Book II,* and adds the use of the pulley and the inclined plane.

Pages 222-226: Experiments. Experiment 1 merely demonstrates a practical application of the change of direction idea, and gets the child gradually accustomed to the idea of how pulleys aid in pulling and lifting. A one-wheel pulley should be used, and the two-wheel type should not be shown until the first experiment is finished.

In this experiment and the others to follow, keep the development entirely on the observation level, aiming at the conclusions the children can draw from trying out the various arrangements.

Page 223 introduces the idea of lifting heavy weights by using a combination of pulleys, and a two-wheel pulley should be shown in connection with this page. If a small one is shown, the approximate size of those shown in the picture at the top of the page should be given, and the explanation made that pulleys are of all sizes. Stress that the pulley shown has two wheels.

Page 224. The pulley suggested above can now be fastened to some overhead object that is far enough from the wall to allow the load to swing free, and near enough the floor for the children to reach it. The children themselves should string the pulley, and enough time should be allotted for the experiment to let it be worked out carefully. The more closely the children follow the course of the rope as it goes up and down between the pulleys, the easier it will be for them to interpret the material that follows.

The outcome of the experiment on page 225 should be that it is easier to lift a load with two pulleys and a rope strung through them as shown than it is to lift the load directly. Experiment 3 on page 226 goes a step farther and compares lifting the same load with two strands and with four strands, arriving at the principle stated in lines 7-9.

In answering the last question on page 226, stress that the rope that pulled up the tent top went back and forth several times between the pulleys, just as the cord does in the experiments.

Page 227. The ropes going back and forth between the pulleys furnish the clue for answering the question at the bottom of the page.

Pages 236-237. The answers expected to lines 5-6 on page 237 are wheels, inclined plane, and pulleys. The answer to the last question is the wheels on the wagons.

VOCABULARY

The following word list presupposes familiarity with the vocabulary of *Science Stories, Books One* and *Two*. *Science Stories, Book Three* introduces 351 additional words.

8
jungle
bushes

9
tiger
tramped
herd
tough

10
monkey
Monk
arms
sucked
squirted

11
charged
sprang

12
hurt
skin
foot
kill

13
able
fitted
jump

14
camel's
wide

15
crawl
caterpillar's
tight
moist

16
waterproof
horned
breath

17
lungs
chest
breathe
spiracles

18
rocks
reach
eagle

19
spread

20
bat

21
magnifying
nuthatch

22
also
beetles

23
tunnel
stiff
above

24
mole
beside
loosens

25
sentence
prairie-dog

26
questions
such

28
pond
aquarium

29
trout
rested
edge

30
still
knocked
flopped
flip

31
Johnny
darter
bottom

32
crayfish
backward
paddles
jerks

33
gills
thin
seem
instead

34
shell
oyster
curly
protect

35
clams
scales

36
marsh
wade

37
Waddles
hatched
excited
toes

39
dive
bite

40
pelicans
gulls
break

41
sandpiper
beaver
heron
bark

42
penguins

43
scorpion
hollow

45
oil

47
snail
turtles
pour
several

49
experiments
tank
filled

50
sure
apart

51
poppies

52
left
finished

53
scattered
already

55
amount
rootlets
deep

56
tap-root
below

57
lose

58
geraniums
fuzzy

59
plenty
leaning

60
ivy
glories
vines
limber
close

62
bend
fasten
mark

63
microscope
hundred

65
years

66
whole
tumbleweed

67
burr
burdock
hooks
cherries

69
water-lilies
pool

70
danger

71
bag

72
lie
hang

73
narrow
tear

74
tall
unless

79
lion
enemies

80
defend
fighting
moose

81
uncle
moth
shoot

82
followed
hawk
spend

83
bumblebee
sting
alone
smell
bad

84
porcupine
quills
alligator
log

85
escape
sounds

86
whirligig

87
octopus
ink

89
polar

91
freezes

93
robber
taste

96
meadow-lark

97
trapdoor

98
silky
safe

99
bangs
wink

100
den
family
hidden

101
brings

102
dam

103
built
piles

105
oriole
lays
cliff

106
cave
wakes

107
during

108
migrate
miles
geese

109
bobolink
junco
raise

113
quail
fooled
ten

114
broken
ahead
matter

115
course

116
quite

117
pebbles
stickleback
glue

118
twenty

119
helpless
fed
parents

120
born

121
opossum
pocket

122
kangaroo

123
six

125
buggy
dresses

129
thistles
juice
bitter

130
smooth
usually

133
needles

135
wrapped

136
pasque
hepatica

137
ferns
cabbage
tips
bloodroot

143
surface
ships
inches

144
globe

147
map

149
stream

150
row
range
peaks
bare

152
United
States

154
swamp
poles

155
words

156
flowing
loud

157
postman
bottles
letter
throw
sight

158
Wabash
Ohio
Mississippi
China

159
traveled
passed
Joe

160
study
measuring

161
empty
becomes

163
banks
flood

165
shore
beach

167
dots

169
Frank
fence
Indian
handkerchief
faces

170
stuck
step

171
circles
hit
shouted

173
oats

174
brook

176
clay

177
sod

178
faucet
ditches

180
gathered
plowed
rushed

182
stir

184
islands

187
rub
wear

188
mixed
gravel

189
notice
grains

190
hay
save

195
raking
loading
forks
circus

196
Helen
Tony

197
stood
driver
tents

198
ropes
ticket
stake
wheelbarrow
drove

200
canvas
center
truck
set

201
pulley

202
harness

203
laced

204
iron
ring
slide

208
cook
peeling

209
parade

210
muscles

211
swing

213
sled

218
tricycle
bicycle
skating

222
flag

223
forth

224
cord

228
slope
inclined
plane
means

229
steep

230
engine
automobile

231
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232
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233
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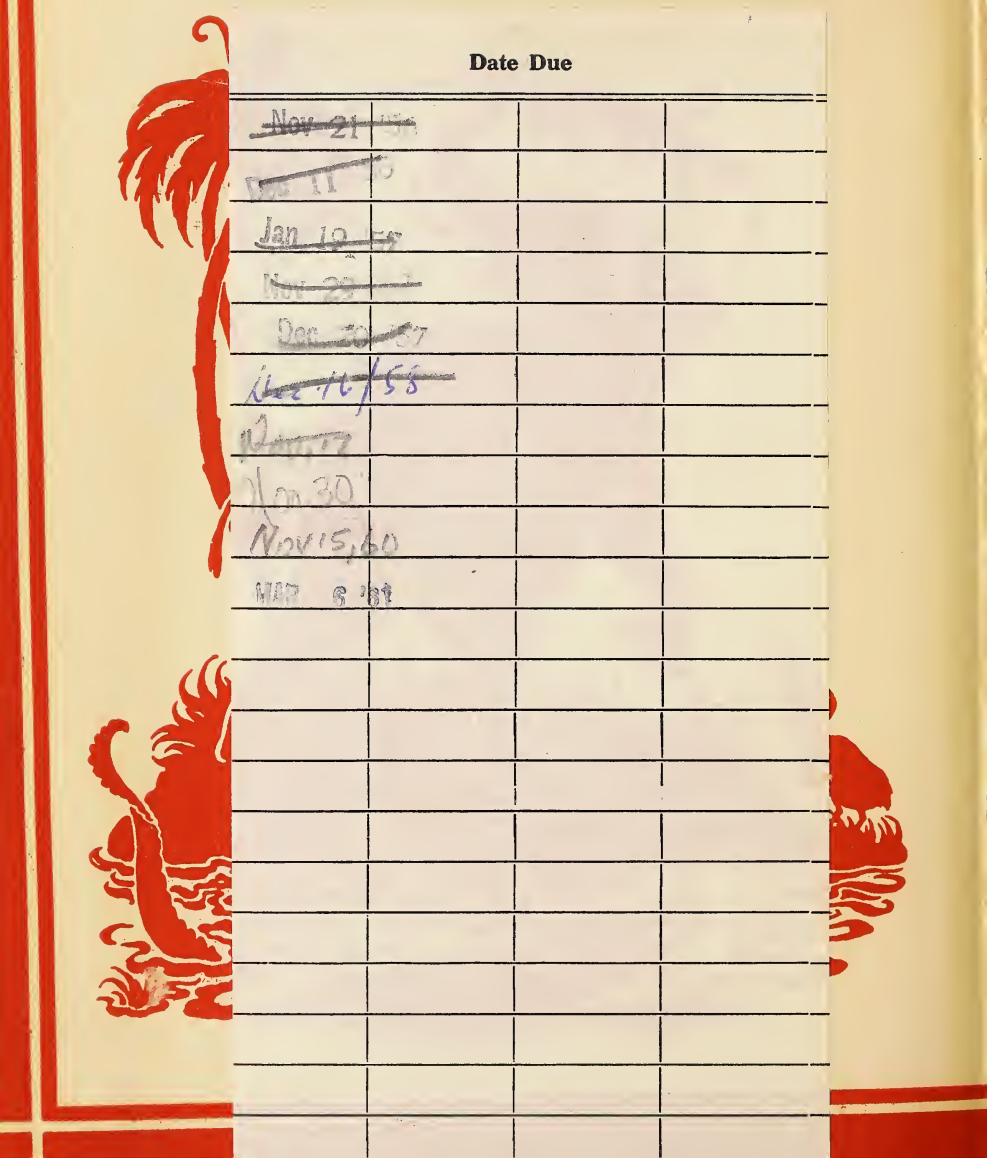

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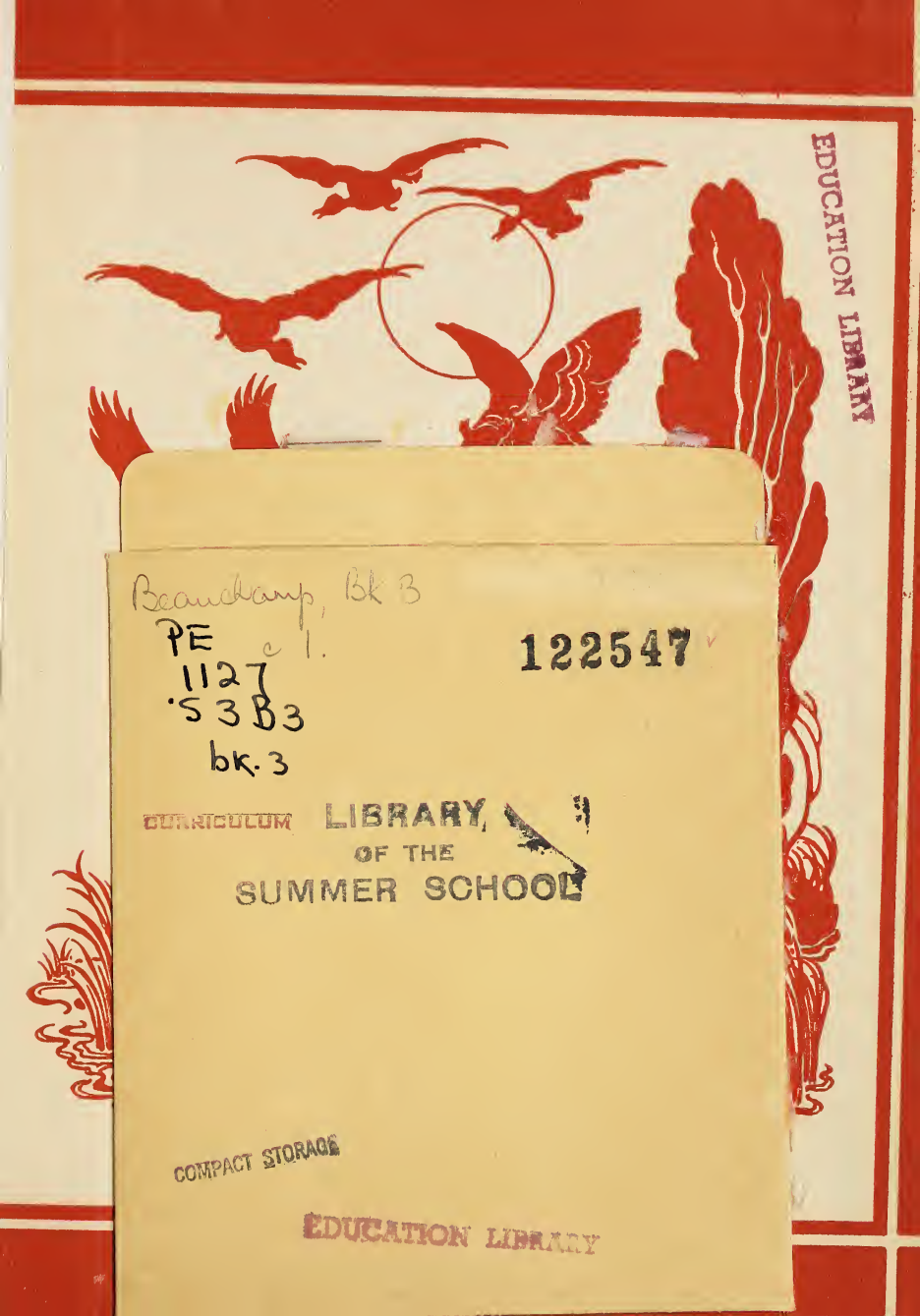

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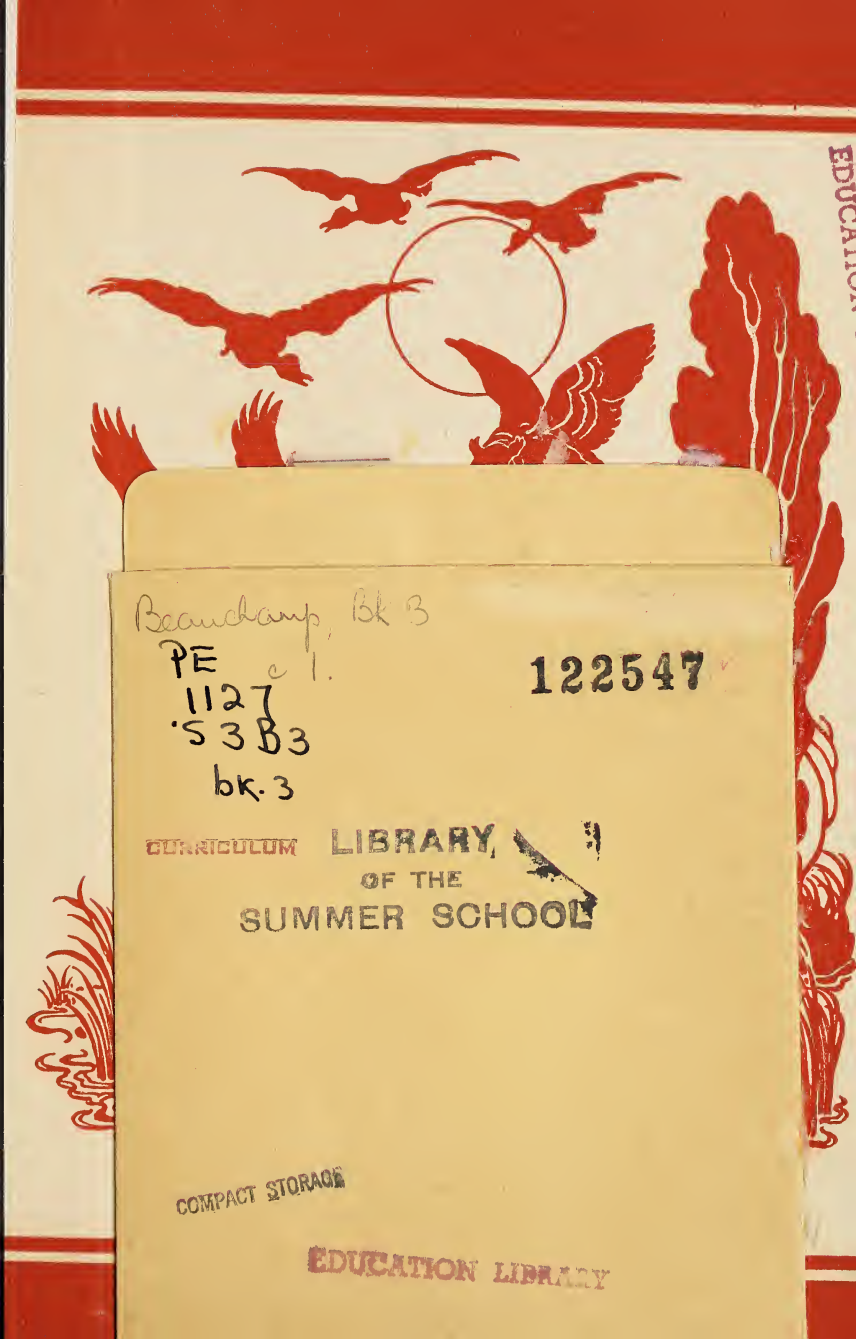

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